JUL 29 1898

THE IRON TRADE REVIEW

VOLUME XXXI. CLEVELAND, O. JULY 28, 1898. CHICAGO, ILL. NUMBER 3

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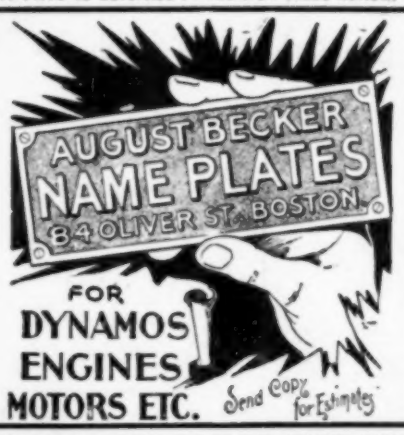

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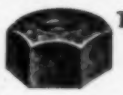

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THE IRON TRADE REVIEW

VOLUME XXXI. CLEVELAND, O. JULY 28, 1898. CHICAGO, ILL. NUMBER 30

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The beginning of peace negotiations strongly reinforces the current of confident expectation that has borne the iron trade forward in the past few weeks. For the moment new business is less than in the earlier part of the month, but already fall calculations are making the sentiment of the trade, though many contracts wait. The mid-summer pig iron statistics, showing 5,909,703 gross tons produced in the first half of the year, and stocks on the market reduced from 874,978 tons to 756,336, give an impressive idea of the amount of iron going into consumption at home and abroad. And when it is considered that the menace of war was present for nearly half the six months and actual hostilities in most of the remainder, there can be little disposition to check the enthusiasm of those who predict better things for the second half of the year. Right here, insight into the real situation of furnaces not now producing is of the highest value. With production declining and the prospect of peace giving color to predictions of expanding trade, in which exports will be a growing factor, the argument for higher prices is well founded, if it be true that the maximum monthly output of the past six months was contributed by practically all the furnaces that can make ends meet on to-day's basis. The argument is strengthened by the probability that some furnaces are still holding on at a loss. In the past week all pig iron markets have been listless, but on the business done quick shipment was wanted, and the rate of deliveries indicates that foundries with few exceptions are well employed. There is no truth in the telegraphic report of a 50-cent advance in Bessemer pig iron, but the market is coming closer to the furnacemen's $10 basis, which promises soon to be realized. The fact that the Mahoning and Shenango valleys produced 350,000 tons more of iron in the first half of 1898 than in the like period of 1897, while stocks decreased 6,000 tons the past six months, indicates the enlarged consumption of Bessemer steel, and the enormous production of the merchant furnaces. Steel billets are a trifle firmer in the Pittsburg district and $14.75 maker's mill is minimum, while close to $15 was secured in a late transaction. On the other hand the heavy purchases recently made in the Cleveland district were at less than $14.25. Export demand is strong, and in the past two weeks several noteworthy sales have been made. Pittsburg reports 30,000 tons of small billets and a less amount of 4 x 4-inch steel. Chicago has taken 3,000 tons of wire rods. Important developments in foreign and home trade may come from the visit of rod and wire manufacturers to the Birmingham district. In all finished lines the outlook for a large export trade in the second half of the year is excellent. The demand for plates and structural material is surprisingly good. One Pittsburg mill has booked orders for plates for 57 locomotives this month. Structural mills are now taking new business fully equal to their current output. Orders for bars from agricultural works keep up steadily, contracts having to be made in addition to what was supposed to be ample for the year. One such contract for 5,000 tons was taken at Chicago, and Central Western mills are having a similar experience.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World.*
808 TRADESMEN'S BUILDING, July 26.

The last of July is welcomed by the iron trade and eyes are turned hopefully to the coming month for better business in nearly all branches. The rumor of a further advance of 50 cents in the furnace association price for Bessemer pig iron from Aug. 1 is without confirmation. The present price is as yet unrealized and an advance is not even considered. The export trade is more of a factor with the mills and is calculated to become a more prominent feature.

PIG IRON.—The price of Bessemer iron is slowly approaching the furnacemen's figure. Some iron is still to be had at less than the $10 valley price but the quantity is small and the price higher than last week. No credence is given the widely published advance to $10.50, valley, in the furnacemen's quotations, for delivery after Aug. 1, and no one is making such a quotation. The basis to-day is from $9.80 to $9.90 valley, and $10.45 to $10.55 Pittsburg. Gray forge is quiet at $9.10 to $9.15. Foundry irons have shown little movement in the last week, No. 2 continuing to be quoted at $10 to $10.15. Quotations are as follows:

Bessemer, valley	$ 9.80 to $ 9.90
Bessemer, Pittsburg	10.45 to 10.55
No. 1 Foundry	10.40 to 10.50
No. 2 Foundry	10.00 to 10.25
No. 3 Foundry	9.50 to 9.75
Gray Forge, valley furnace	8.70 to 8.75
Gray Forge, Pittsburg	9.10 to 9.15

BILLETS AND RODS.—While the range of the billet market is practically the same as heretofore, transactions are at nearer the maximum than the minimum price quoted. A round lot was sold recently at close to $15, delivery to the end of the year and the outlook is for continued firmness. While the leading wire interest is credited with having purchased a large tonnage it may safely be said that no large amount has been purchased in Pittsburg. The export trade is gradually becoming more and more of a factor in the market. Two orders, one for 30,000 tons of 2-inch billets and a smaller one for 4x4-inch billets have been taken recently. We quote billets at $14.75 to $15, maker's mill Pittsburg and $14.50 valley and Wheeling district. Sheet bars and tin plate are quiet at $16.50 to $16.75 maker's mill. The quotation on rods is $19.75 to $20, with little doing.

STRUCTURAL MATERIAL.—Last week saw an excellent tonnage placed in this line. The largest structural order, which was placed with the Keystone Bridge Works, for a bridge over the Allegheny river, at Moss Grove, was for about 2,000 tons. Others were smaller in size but the aggregate tonnage was large. Prices are as follows: Beams and channels, 3 to 15 inches, 1.15c; 18 to 24 inches, 1.25c; tees, 1.20c; zees, 1.15c, and angles, 1.05c. Universal plates in connection with other shapes are selling at 1c; alone, at 1.10c.

PLATES.—The volume of business in plates has grown materially in the past week. While prices are in general unchanged, the tendency for a stiffer market noted last week may be said to be more marked. A local firm has thus far this month received orders for material for 57 locomotives. Prices are as follows: Tank, 1.10c to 1.15c; shell, 1.15c; flange, 1.20c; fire-box, 2c and upwards.

IRON AND STEEL SKELP.—The market is in very good condition, the demand for wider sizes, both iron and steel, being particularly good. Prices are as follows: Grooved iron skelp, 1.05c to 1.07½c; sheared iron skelp, 1.10c to 1.12½c; grooved steel skelp, 0.95c to 0.97½c; sheared steel skelp, 1.10c to 1.12½c.

SHEETS.—The last week seems to have brought increased business to most of the sheet mills, some of them being now in operation that a week ago had scarcely enough work to keep them going. The quotation on No. 28 is still from 1.92½c to 1.95c. Galvanized sheets continue at 80 and 7½ to 80 and 10 per cent off list with 18 cents freight.

RAILS AND TRACK MATERIAL.—The demand in this material continues heavy. Spikes still retain the lead in activity and are quoted at 1.40c to 1.45c. Other prices are as follows: Rails, $18, Pittsburg; iron track bolts, 1.65c to 1.70c; splice bars, 1.10c to 1.15c; links and pins, 1.20c.

SPELTER.—Spelter continues to fluctuate, the price now being $4.50 to $4.55.

SPIEGEL.—There is no immediate demand and prices remain at $23.50 to $24.

PIPES AND TUBES.—This branch of the market is in good condition so far as business is concerned but prices remain unchanged. The mills are crowded and prompt delivery seems impossible. If a prompt order is filled it is usually a case of satisfying an importunate customer and putting off the easy going buyer. The same additional discounts of six tens for less than carload lots and six tens and two and a half for carload lots are quoted. Base discounts are as follows: Butt weld, black, 57 per cent off; lap weld, black, 67 per cent off; butt weld, galvanized, 50 per cent off; lap weld, galvanized, 55 per cent off. Discounts on merchant boiler tubes are as follows: 2¼ inch and smaller, 72½ per cent off; 2½ inch and larger, 75 per cent off. Inserted joint casing is quoted at 60 and 5 per cent and screw and socket joint at 65 and 5 per cent.

OLD MATERIAL.—While demand for old material is slow there is some movement in small lots. The largest sale reported is 1,500 tons of heavy mixed steel scrap at $10.25 gross. Other quotations are: Old iron rails, $13.50 to $13.75, valley; cast borings $5.75, net, valley; wrought turnings, $7.25 net, valley; railroad cast scrap, $9.50; wrought scrap, $11.50, valley; iron axles, $16, net; steel axles, $12.50, gross; car wheels $10.50, gross; charcoal scrap, $10, gross; billet and bloom ends, run of mill, $11; busheling scrap, $9.50 net; machine scrap, $9 gross.

FERRO-MANGANESE.—The market is steady and the quotation is $49.50 to $50, for 80 per cent domestic delivered.

CHICAGO.

OFFICE OF *The Iron Trade Review and Industrial World.*
1522 MONADNOCK BLOCK, July 27.

The week has shown fairly good sales of nearly all kinds of finished material, although the tonnage was hardly as large as that closed in any one of the four or five weeks immediately preceding. Raw material is in small demand for the present, and sales have been only light. The mills and furnaces in this district continue to run full, and are expecting that the fall trade will open earlier and larger than usual.

BARS.—Business last week was good, and included one contract for 5,000 tons of steel bars from an implement manufacturer. Some buyers of this class find that their recent purchases will hardly run them through their season, and are making arrangements to procure larger quantities of material. It is thought additional purchases of this character will run into considerable tonnage before the year is over. Orders for small lots are frequent and make a good total. The market is a little firmer, and 1.05c to 1.10c seems to be the accepted price now for common iron, although good specifications could probably be placed at a lower figure. Guaranteed iron is quoted at 1.15c to 1.20c and soft steel bars at 1.10c to 1.15c.

PIG IRON.—There has been very little demand for any grade of pig iron, and sales by both Northern and Southern furnaces were small. No large contracts were closed, and there do not appear to be any in the market at present. The furnaces are all being pushed for shipments, and those in this territory are having all they can do to keep up with their contracts. Foundries are nearly all running full, and are taking iron fully as fast as provided in contracts, in many cases faster. There is no doubt that the fall business of the furnaces will be very heavy, if the foundry business in this territory keep ups at anything like its present rate, and this it bids fair to do for some time. There have been no changes in prices, although some of the larger Southern furnaces have advanced soft grades from 10 to 25 cents a ton. The smaller companies, however, are making the same prices that have been prevailing for the past several weeks.

Lake Sup. Charcoal	$11 50 @$13 00	Southern Coke No. 3	$ 9 75 @$10 00
Local Coke Fdy. No. 1	11 50 @ 12 00	Southern No. 1 Soft	10 35 @ 10 60
Local Coke Fdy. No. 2	11 00 @ 11 50	Southern No. 2 Soft	10 10 @ 10 35
Local Coke Fdy. No. 3	10 75 @ 11 00	Southern Silveries	11 25 @ 11 50
Local Scotch Fdy. No. 1	11 50 @ 12 00	Jackson Co. Silveries	13 50 @ 14 50
Local Scotch Fdy. No. 2	11 00 @ 11 50	Ohio Strong Softeners	12 00 @ 12 25
Local Scotch Fdy. No. 3	10 75 @ 11 00	Alabama Car Wheel	15 00 @ 16 00
Southern Coke No. 1	10 35 @ 10 60	Malleable Bessemer	11 50 @ 12 00
Southern Coke No. 2	10 10 @ 10 35	Coke Bessemer	11 50 @ 12 00

RAILS AND TRACK SUPPLIES.—Only a small business was done in rails last week. The local mills are full of orders for the balance of the year, and are not pushing for business. Quotations are as follows: Rails, $20 to $22.50, according to specifications; steel splice bars, 1.15c to 1.25c; track bolts, with square nuts, 1.80c to 1.90c; hexagon nuts, 1.90c to 2c; spikes, 1.50c to 1.60c.

BILLETS AND RODS.—Sales of 2,000 or 3,000 tons of rods for export were made from this market last week, and some domestic business was done, although it was not heavy. Billets were quiet, with only small sales. Prices are unchanged, at $15.75 for billets and $20.75 for rods.

CAR ORDERS.—Several quite large orders for cars have been given out and further business is expected immediately. Car material is selling well, although most of the business is in comparatively small lots.

STRUCTURAL MATERIAL.—Last week was the quietest that has been had for two months or more. No large contracts were let, and none came up to be bid upon. General business was comparatively small, although a fairly good total tonnage was sold. Quotations are as follows: Beams, 15-inch and under, 1.30c to 1.35c; 18, 20 and 24-inch, 1.40c to 1.45c; angles, 1.20c to 1.25c; plates, 1.15c to 1.25c; tees, 1.35c to 1.40c. Small lots from stock are quoted at ¼ to ½ cent higher.

PLATES.—Business continues good, and the total of last week was fully up to the expectations of the dealers. Most of the business placed was in small lots, but one or two good contracts were closed. Prices are made as follows: Tank steel, 1.15c to 1.25c; flange steel, 1.20c to 1.40c; fire box steel, 1.85c to 5c.

SHEETS.—The market is quite active, and sales have been as good as the dealers expected, mostly in small lots, though including several good sized contracts. No. 27 black sheets are quoted at 1.95c to 2.05c, and galvanized at 80 and 10 and 2½ per cent discount.

MERCHANT STEEL.—There continues to be a good demand for merchant steel of all kinds, and sales last week were above the average for this season of the year. Included in the business were several quite large contracts, and more business of this character is expected to be placed immediately. Prices follow: Open-hearth spring, tire and machinery steel, 1.60c to 1.70c; smooth-finished machinery steel, 1.60c to 1.65c; smooth finished tire, 1.50c to 1.60c; tool steel, 5.50c to 7.50c; specials, 11c and upwards.

SCRAP.—Dealers are having rather a dull time at present, with only small sales, and very little likelihood of their increasing immediately. The demand is not at all heavy, and shows no indications of a betterment. Dealer's selling prices are as follows:

Old iron rails, gross, $12 25@$12 50		Axles, net	$14 25@$14 75
Old steel rails, long, gr.	10 50@ 11 00	Cast borings, net	4 25@ 4 50
Old steel rails, short	8 75@ 9 00	Wrought turnings, net	6 00@ 6 50
Old wheels, gross	11 00@ 11 50	Axle turnings, net	7 00@ 7 25
Railroad forge, net	11 50@ 12 00	Mixed steel, gross	7 25@ 7 50
Dealer's forge, net	10 00@ 10 50	Stove plates, net	5 75@ 6 00
No. 1 mill, net	7 50@ 8 00	Heavy melting steel, gr.	8 25@ 8 50
Heavy cast, net	8 50@ 9 00	Old iron splice b., net.	12 75@ 13 00
Malleable cast, net	8 00@ 8 50		

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World.*
27 VINCENT ST., July 27.

The market has been devoid of incident in the past week. While there is a steady run of small lot orders in finished material and pig iron, the evenness of prices and the absence of large orders gives the usual aspect of mid-summer dullness. In reality there is far more than the average mid-summer business going. In the iron ore trade heavy shipments keep

up, with record-breaking cargoes. One of the latest freighters took 6,959 gross tons from Duluth last week. Vessel men find little more demand for ore tonnage, but the grain situation has improved, taking some of the surplus boats off the market.

PIG IRON.—The restrictive movement in the valleys has brought production down to the lowest point in months. At New Castle, the shut-down of the three furnaces affected by the strike was prolonged through last week for needed repairs. Mary Furnace, at Lowelville, went out this week. Struthers is banked for two weeks of repairs. The Stewart Iron Co. will make important improvements within the next few weeks. The newspaper reports of an advance of 50 cents in Bessemer iron Aug. 1 are untrue. There are indications, however, that the $10 figure may be the basis of considerable transactions in the near future. The increase in the output of valley furnaces in the past six months is even more, the statistics show, than had been reckoned. The Mahoning valley produced 413,065 tons of iron in the first half of the year—96,100 tons more than in the second half of 1897, and 147,734 tons more than in the first half of that year. The Shenango valley's output was 426,365 tons, a gain of 100,954 over the second half of 1897, and of 205,321 tons over the first half. Allegheny county, on the other hand, with a total of 1,465,535 tons from Jan. 1 to June 30, increased only 14,000 tons on its output in the second half of 1897. Foundry iron has sold principally in car lots and 100-ton lots for quick shipment, in the past week, prices holding close to the $9.50 furnace basis for No. 2. We quote f. o. b. Cleveland:

Bessemer,	$10 65	Valley Scotch No. 1	$10 40@10 65
No. 1 Strong Foundry	10 40@10 65	Valley Scotch No. 2	10 25
No. 2 Strong Foundry	10 10@10 40	Gray Forge	9 25
No. 3 Foundry	9 65	Lake Superior Charcoal	11 50

STEEL BILLETS.—The recent purchases of the American Steel & Wire Co. have been much discussed. It is now understood that the 100,000 ton contract went to a Northern Ohio steel works, and that the price was below $14.25. At this figure it is believed some shipments will be made to other than the Cleveland plants of the combine, in view of the heavily sold condition of Chicago steel works. A Cleveland mill is in the market this week for 3,000 tons of slabs. We quote wire rods at $19.50, Cleveland.

FINISHED MATERIAL.—Agricultural and bridge works continue to be prominent sources of demand. Agricultural buyers, who were supposed to have covered their wants through the year, are making further purchases, indicating that another big year is ahead of that industry. Some local bridge work is to be done, including 500 tons for the Willett st. bridge. Prices on beams and channels, to 15 inches, are still maintained at 1.23½c, Cleveland; on plates, 1.16c to 1.18½c; angles, 1.05c. In steel bars a steady demand is noted, with prices a trifle firmer in the case of sellers heretofore weakest. We quote 1c Cleveland, for iron and steel bars. Sheets are fairly active at 1.95c, Cleveland, for No. 27. Wrought pipe and boiler tube business is steady at unchanged prices, six 10s to six 10s and 5 being quoted as additional discounts on merchant pipe.

CINCINNATI.

July 26.

The dullness continues and seems likely to last for several weeks. As one buyer expressed it, "It is too hot to buy pig iron." A few sales of 500 tons each and one or two of 1,000 tons each are reported at a shade below $7 Birmingham, for No. 2 foundry. All the mills in this locality are closed and so are the agricultural implement works. The peculiar feature of the business is that few requests to hold up shipments are received, while on the other hand many urgent requests for the prompt shipment of iron are received, which is not usual at this season of the year. There are some interesting things, however, going on in the trade and it is regarded probable that the first of September will see a good buying movement. Already some of the largest furnace companies have refused to make the concessions they were willing to make a week or two ago. It is almost impossible to get No. 1 soft and No. 2 foundry iron shipped promptly, as demand is greater than the supply. Alabama charcoal car wheel iron is moving a little better at from $14.25 to $15.25 at Cincinnati. There seems to be a shortage in the high numbers of charcoal iron, which makes old car wheels in strong demand. It is conceded by all that the statistical position is strong. The production has decreased at as great a rate, if not greater, than the consumption, and stocks are lower. Many here believe the decrease in stocks of July will be as great as in June. Quotations f. o. b. Cincinnati are as follows: Southern coke, No. 1 foundry, $9.50; No. 2, $9.25; No. 3, $8.85; No. 4 and gray forge, $8.50; mottled $8.25 to $8.50; No. 1 soft, $9.50; No. 2, $9 15; Tennessee charcoal, No. 1, $12.50 to $13; Hanging Rock charcoal, No. 1, $14.50 to $15.50; Jackson county silvery, No. 1, $12 to $12.50; standard Georgia car wheel, $14.25 to $15.

BUFFALO.

July 26.

Rogers, Brown & Co. say: "The market now begins to feel the effect of the usually dull summer months so far as sales of foundry iron are concerned. So far as shipments on existing contracts are concerned, however, there has been no let-up, with none in sight. A careful canvass of the melters in this district shows that consumption is gaining, although very slight. A stronger feeling is noticed and all look for a prolonged period of prosperity as soon as the war is over." We quote below for cash f. o. b. cars Buffalo: No. 1 strong foundry coke iron, Lake Superior ore, $11 to $11.25; No. 2, $10.50 to $10.75; Ohio strong softener No. 1, $11.50 to $11.75; No. 2, $11 to $11.25; Jackson Co. silvery No. 1, $14; Southern soft, No. 1, $11.50 to $11 .75; No. 2, $11.15 to $11.35; Lake Superior charcoal, $11.50.

PHILADELPHIA.

July 25.

The effort of most sellers seems to keep well booked ahead and to leave improvement in prices to the future. The unprecedented output of pig iron in the first half of the year is cited in some quarters as a guarantee of substantially to-day's basis of prices, and the accompanying reduction of stocks is not regarded as significant, since consumers stocks are not known. One element is to be reckoned with, however, and that is the increase in exports that is likely in the second half of the year. It is well known, too, that present production will not be greatly increased, so long as the prevailing price basis is maintained. In pig iron there is a somewhat better demand, with no improvement in prices. Buyers are taking considerable prompt iron on small orders, with now and then a contract for forward delivery. The usual basis is $10.50 for No 2X and $10 to $10.25 for No. 2 plain, with $10 and a shade under prevailing for mill iron. Somewhat more inquiry is noticed in billets and $16.50 is buyer's idea of what the market should be for deliveries in the next four or five months. The finished material market has still the features of active operations by plate and shape mills, the latter having a good supply of small or moderate orders while sheet mills are doing better in some cases. The weak prices for bars and sheets, particularly the former, continue. There seems practically no chance of improvement. We quote plates at 1.20c for tank; angles, 1.20c to 1.25c; beams and channels, up to 15 inches, 1.30c; refined bar iron, 1.15c to 1.20c; soft steel, 1.10c.

Received from the Trade.

The Spencer automatic screw machine is described and illustrated in a cloth-bound catalogue of the Spencer Automatic Screw Co., Hartford, Conn. The Spencer machines whose construction is shown by excellent half-tones, are designed for the manufacture of every variety of machine screws and turned metal parts. Three sizes of the machine are illustrated, in the double turret and single turret styles. The double-turret machine has a forward and a rear turret, acting in conjunction with a primary and a secondary spindle. This makes possible the employment of two complete sets of tools and the simultaneous performance of two series of operations on opposite ends of a piece.

THE Norwalk Foundry & Machine Co., of Norwalk, O., is in the market for an extra length galvanized iron folder, rolls, turning machine, double seamer stake with heads and soldering furnaces, with good heating capacity suitable for heavy galvanized work. Good second-hand tools are preferred.

THE IRON TRADE REVIEW

AND

INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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IRON TRADE COMBINATIONS.

There is a revival of the talk of steel works consolidation, that was current two months ago. As was stated in these columns at that time, no reliable foundation exists for the report that the Minnesota Iron Co. and the Illinois Steel Co. will enter a combination with certain Pennsylvania steel companies outside of the Pittsburg district. There is no community of interest to suggest such a merger of the Chicago company with any one of the three Pennsylvania companies named in this connection or with all combined. Competition is not to be less but rather more of an element in the iron trade, and it may be accepted as a general rule that the changes in organization and equipment of the steel companies of the country will be rather with a view to meeting stronger competition than to lessening it. On behalf of several of the Eastern companies official statements have been made disavowing any such plans as have been exploited in the newspapers. It has been admitted, however, on what appears to be good authority, that a committee from the Illinois Steel Co. and one from the Minnesota Iron Co. have been in conference to determine whether it would be for the best interests of both to combine. There would be advantages to both parties, in such an arrangement, which differs from the usual combination proposition, in that the parties are not competitors. The resulting corporation, should one be formed, would be different from any in existence, there being now no steel company that is a seller of ore on any scale, as well as a consumer.

The natural source of supply of the Illinois Steel Co., for a large part of its old range ore, at least, is the Michigan district from whose port it has the advantage of an exceedingly low water rate. But combination with the important mine, railroad and vessel interests of the Minnesota Iron Co. might give advantages compensating for the use of larger supplies of ores from the Minnesota ranges. On the side of the Minnesota Iron Co. the advantage of uniting with a large producer of steel grows out of conditions on the Mesabi range. The Minnesota Iron Co. would continue to be a leading producer of ore, whether its ores were consumed by the Illinois Steel Co. or not; but it can be appreciated that the possibility of such a change in the ownership of Illinois Steel Co. stock as would make the latter a large purchaser of ore from the Minnesota Iron Co.'s rival on the Mesabi range would be an important consideration in connection with the proposed deal. The combination, on whatever basis effected, would be only in line with other centralizing tendencies in the iron trade. Not the least significant feature of it would be the elimination of some important middle interests.

INCREASING THE CIRCULATION OF GOLD.

An article in the July issue of the *Bankers' Magazine*, of New York, by Alexander E. Outerbridge, Jr., calls attention to the astonishing fact, shown by official figures, that more than two-thirds of all gold coined at mints of the United States has disappeared from circulation. Mr. Outerbridge shows from the reports of the Treasury Department that the total value of all our issues of gold coin from the establishment of the mint in 1792 to June 30, 1897, is $1,886,338,958. Of this amount it is estimated that $671,676,250 is now in existence as coin in the United States, while the remainder, $1,214,662,708, represents the excess of exports over imports and the amount used in the arts. The interesting fact that more than two-thirds of the gold coins struck at the mints of the United States have disappeared from circulation, is connected with another quite as interesting, namely, that the amount that has disappeared corresponds very closely with the total of double eagles coined by the Government. Since 1850, when their coinage began, double eagles to the value of $1,337,498,040 have been issued. Mr. Outerbridge suggests that the correspondence between the two aggregates is more than a coincidence. The policy of other countries, where gold is the standard, to issue gold coins of convenient size and value for circulation among the people, has given place in the United States to a policy which keeps down the circulation of specie, increases the use of paper money at home and facilitates the export of gold coin to foreign countries where it is recoined into smaller denominations.

It will be recalled that the free silver orators of 1896, used with telling effect in their addresses before popular audiences, the question, "How much gold have you seen in the last 12 months?" With this bit of sophistry the impression was conveyed that the gold basis, so far as the United States is concerned, is merely a name, a "gold-bug" fiction. So much harm was done by this insinuating method of campaign that as a demonstration to the great army of clerks and shop employes in the cities, many banks, in the midst of the canvass of 1896, cashed pay-roll checks with gold, so that the sight of yellow coin might help to rid the people's minds of the fallacy. It is needless to say that the free-silver propaganda is very much alive in the

United States to-day, and that the absence of gold in the transactions of ordinary business takes strong hold of unthinking minds, attempting to grapple with the intricacies of finance. There is value, therefore in the suggestion of Mr. Outerbridge that a modification of our coinage laws should be made, limiting the proportion of large denominations of gold pieces permitted to be struck each year. He says:

It is, of course, evident to the student of economics and finance that the course of trade with foreign countries is not influenced in any appreciable degree by the particular denominations of gold coins struck in this or any other country. For example, if Europeans shall again sell our bonds, as they did so freely a few years ago, and shall demand payment in gold, as they did then, with perfect right; and if we shall have, in the future, seasons of poor crops, and shall have comparatively few commodities to sell in foreign markets, as has occurred more than once in the past, the golden stream will again flow in the opposite direction; nevertheless, the contention is here made that the future policy of this Government should be to encourage the circulation of gold among the people by the issuing of gold coins of denominations suitable for distribution from hand to hand, in payment of debts of moderate amounts, in preference to striking chiefly gold coins that are too valuable for common use.

Certainly no better time can be selected for this campaign of education—for such we believe it would be, seeing that this is a country where financial policies are settled by ballot box count—than one in which the golden stream is steadily flowing inward. It will be valuable to have the people know by actual every-day experience that the supply of gold is growing more plentiful.

In speaking of the failure of the producers of foundry and forge irons to perfect an organization for the cure of demoralized prices, the *Bulletin* says:

The truth is that this country is too big to permit of an agreement of any kind being reached and respected by pig iron manufacturers. There are too many of them, their interests are not identical, their financial necessities differ, and mutual confidence must always be lacking. Twenty years ago and more we reached the conclusion that our pig iron manufacturers can form no exception to the inexorable law which declares that only the fittest shall survive. In these years this law has been actively in operation in our pig iron industry, and the end is not yet. "'Tis true 'tis pity; and pity 'tis 'tis true."

Scarcely a month passes but some furnace firm makes a decision that is the casting of the die. Whether $50,000 to $100,000 shall be added to the investment, so that an approximation to "modern" capacity may be attained, and the race kept up for a while longer, with no assurance that the profit meantime, if any, will not all be absorbed in a similar effort to catch up, two or three years hence, is the solemn problem that is confronting furnacemen, under the profitless prices of to-day. The alternative is to go out and wait for higher prices. Many furnaces have been waiting for one, two years. Their last opportunity was in 1895. The next—well, for many of them, it will never come.

The American Pig Iron Storage Warrant Co. had in yards July 20, 252,400 tons, the amount put in yard in the preceding 10 days being 2,100 tons and the amount withdrawn, 5,800 tons.

IRON WORKS MANAGEMENT.

The question of the relative value of technical and managerial skill in the conduct of large iron and steel works is raised by an English contemporary. In discussing an unpleasant feature of a recent meeting of directors of the well known Ebbw Vale works, it says:

"Can it be that the strong men of the iron trade have now entirely disappeared, and that there is no one left to fill the place of Agamemnon, or wear the mantle of the Darbys, the Guests, and the Crawshays? That, at least, appears to be the deplorable condition of things indicated by the efforts of the directors of the Ebbw Vale to find a manager who realizes their ideals. Listen to the following confession from the chairman of the company:

The board was of opinion that there was room for very great improvement at Ebbw Vale, and were convinced that they ought to be, and might be, doing very much better. He believed it was the universal opinion of the company that what was needed was a competent general manager, who would superintend the whole of the works, live on the spot, and be thoroughly master of the whole of the details of the business. The directors fully appreciated the importance of having such a head to a large concern like theirs, a man capable of dealing with and controlling its enormous interests. They felt that the sooner it was done the better, and they would make such an appointment as soon as they could see their way to doing it with a fair prospect of success. But they must recognize that it was difficult to find a duly qualified man to control such an undertaking.

"And this dismal and disheartening confession from the chairman was thus emphasized by one of the shareholders, who had nothing very complimentary to say about the management of the company's affairs."

He complained that the two furnaces which they had were altogether inadequate for modern needs in rail making; in fact, they were almost like going back to prehistoric times. Whereas in other works they rolled six rails in a piece, they were rolled singly at Ebbw Vale, and the result was that there were six times as much scrap and waste to be cut off the rails. He thought the furnaces had had a good trial, and had proved failures, and ought to be done away with. No concern could go on with such defective apparatus. He emphasized the need of a general manager, and thought it showed serious want of judgment on the part of the directorate to have gone on two years without such an official.

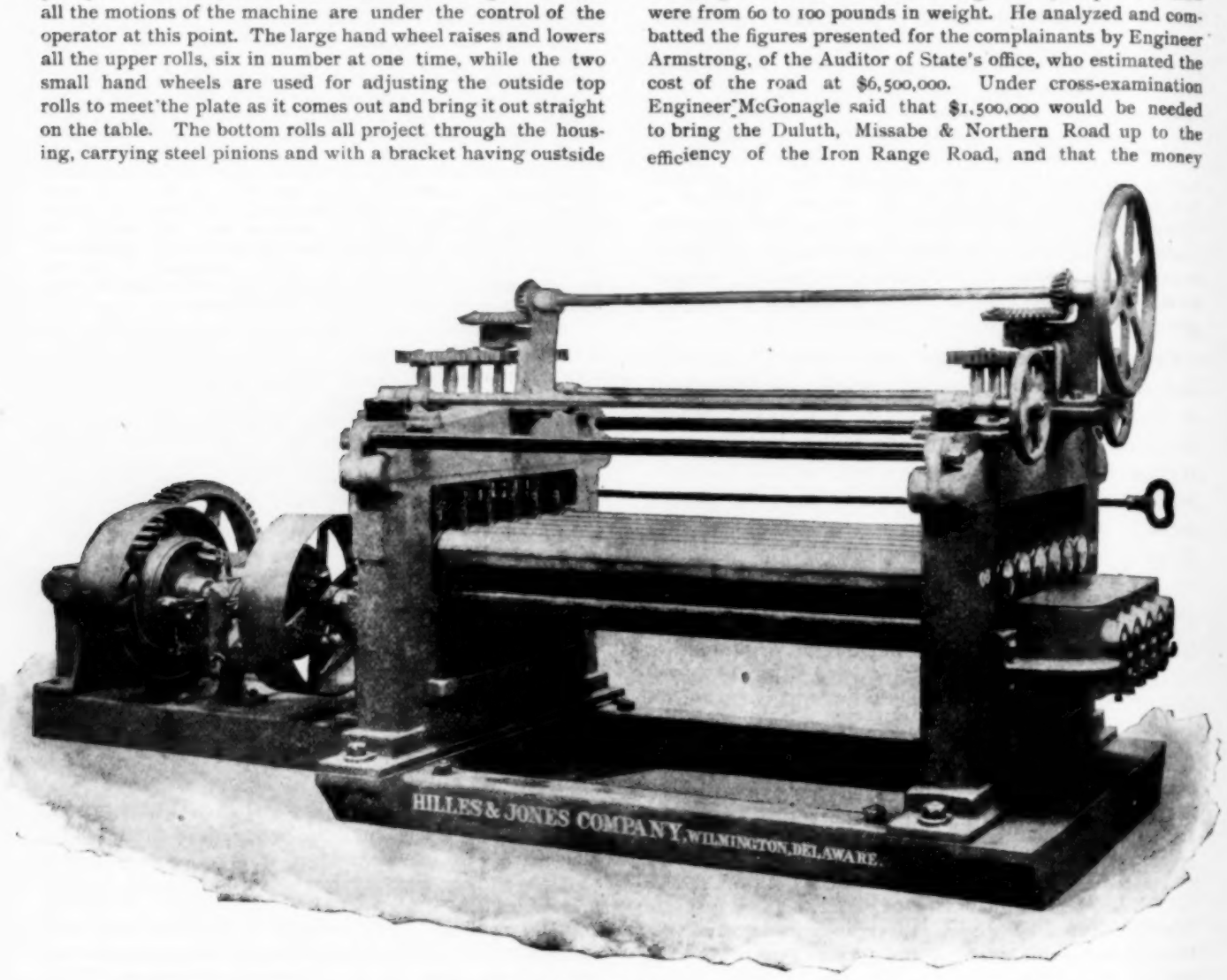
"This, surely, is hardly the record that the shareholders have a right to look for from a board that ostensibly came into office for the purpose of cleansing the alleged Augean stable left by their predecessors. It is surely time that the Ebbw Vale shareholders were again setting their house in order if the facts be as stated here.

"The business of managing a large concern like Ebbw Vale is no child's play, and it has always been difficult to define exactly what the qualifiations of a really suitable man should be. The prevailing impression seems to be that the first requisite of a successful general manager is that he should be saturated with technical knowledge. Hence the majority of the general managers in this country have been technical men first and business men afterwards. This is probably a mistake. Carnegie, Armstrong, Frick, Bessemer, and a whole host of others who might be named, whose success has been phenomenal, were not, to begin with, technical ment at all. On the other hand, it would be easy to cite the names of technical men who have not been conspicuous as successful managers of great undertakings. The first essential of a successful manager is that he should be a first-class business man, with large and yet exact ideas of the lines on which his enterprise should be run, and with a high capacity for selecting and controlling his heads of departments. Of technical men, so-called, there is a vast and probably generally over-abundant crop. Our technical colleges, schools, and institutions have been turning them out by hundreds for years past. Surely there could be no greater reflection upon this form of curriculum than the fact that the Ebbw Vale directors appear to have been unable to find a general manager worth his salt. One can conceive that under these distressing circumstances they might do worse than reappoint a man who has, so far as I know, many of the needed qualifications, with a thorough knowledge of the company's affairs, which it would probably take a new man a year or two to acquire, during which he would not be so useful and reliable as the circumstances of the case demand."

LIGHT MILL-TYPE STRAIGHTENING ROLLS.

The machine illustrated below is a light design of "mill-type" straightening rolls. While in some respects similar to the straightening rolls also manufactured by Hilles & Jones Co., of Wilmington, Del., illustrated in our issue of June 16, it is intended to handle much lighter plates. The plates are received hot, as they come from the main rolls. This tool has 11 forged steel rolls, each 5 inches diameter, 62 inches between housings. The housings are of the open-top type, so that by removing a cap any roll can be taken out without disturbing the gearing.

The driving is done through a pair of duplex friction clutch pulleys which are operated from the back housing end so that all the motions of the machine are under the control of the operator at this point. The large hand wheel raises and lowers all the upper rolls, six in number at one time, while the two small hand wheels are used for adjusting the outside top rolls to meet the plate as it comes out and bring it out straight on the table. The bottom rolls all project through the housing, carrying steel pinions and with a bracket having oustside bearing to take the thrust of the pinions, motion being conveyed through cast steel idler pinions. There is a substantial box form bed plate under the entire machine and all details have been carefully worked out to give the best mill service. These machines are supplied by the Hilles & Jones Co. for a variety of requirements.



MILL-TYPE STRAIGHTENING ROLLS.

THE Illinois Steel Co., at its South Chicago Works, recently rolled two of the largest open-hearth steel boiler plates ever made, to be the shell surrounding the fire-box of a consolidation locomotive. Each of the finished plates were 124 inches wide and 220 inches long on one edge and 237 inches on the other; the original sheets before the shearing were 128 inches by 360 inches for one and 130½ inches by 375 inches for the other, while the ingots from which they were rolled had a cross section of 18 inches by 40 inches.

ROGERS, BROWN & Co., in the first six months of 1898 sold 497,809 tons of pig iron, as compared with 377,876 tons in the first half of 1897. The sales of coke were 104,335 tons during the first half of this year, as compared with 38,604 tons in the first six months of 1897.

LAKE SUPERIOR IRON MINES.

The ore freight rate hearing at Duluth was resumed on July 20. Testimony was confined almost entirely at last week's sessions to the value of the railroads —cost of right of way, of rolling stock, terminals, docks and construction. Engineer McGonagle, of the Duluth & Iron Range Road, presented figures showing a cost of $15,319,000 for that line. He testified that the road had been built as cheaply as possible, consistent with work by responsible contractors, and that work had been going on constantly since the road was built in repairs and improvements. The chief items in construction were $2,841,778.81 for equipmennt, $1,315,000 for docks and dredging. The steel rails were bought at $22 per ton and were from 60 to 100 pounds in weight. He analyzed and combatted the figures presented for the complainants by Engineer Armstrong, of the Auditor of State's office, who estimated the cost of the road at $6,500,000. Under cross-examination Engineer McGonagle said that $1,500,000 would be needed to bring the Duluth, Missabe & Northern Road up to the efficiency of the Iron Range Road, and that the money should be spent at once. This week the railroad commission will make a tour over the two roads.

The latest ore-cargo record was made July 25, at Duluth, when the John Fritz, the latest addition to the Bessemer Steamship Co.'s fleet loaded 7,794 net tons of ore on a mean draft of 17 feet 11½ inches. This is 6,959 gross tons.

Reports of recent development work indicate that properties of some value may be added to the active list on the Vermilion and Mesabi ranges. On the latter the Wright & Davis property in the Hibbing district will probably be opened preparatory to shipping in 1899. Section 26, near Ely, is reported to have shown a good body of ore, though the extent of the body is not yet known. The exploratory work has been done by John G. Brown and A. M. Miller.

The Minnesota Iron Co. is exploring to the west of its hard ore mines at Soudan. It is reported that diamond drill work has revealed a large lens of ore, the iron outcropping on the property on which explorations are being conducted.

The Duluth, Missabe & Northern road is hauling into Duluth daily 30 trains of ore, amounting to about 35,000 tons, and the Duluth & Iron Range is handling not far from 40,000 tons.

PIG IRON PRODUCTION, FIRST HALF OF 1898.

The American Iron and Steel Association has just received from manufacturers and publishes in the Aug. 1 issue of the *Bulletin*, complete statistics of the production of all kinds of pig iron in the United States in the first half of 1898; also complete statistics of the stocks of pig iron which were on hand and for sale on June 30. They show that the output of our blast furnaces in the six months ending June 30, was much the largest half-year's production in our history. The total is 5,909,703 gross tons; the next largest was 5,358,750 tons, in the second half of the boom year 1895. In the first half of 1897 the total was 4,403,476 tons; in the second half, 5,249,204 tons. The average monthly production since Jan. 1 has been nearly 1,000,000 tons; the total for the six months was 226,374 tons larger than that for the entire year 1886, which was then considered large.

Only 19 States made pig iron in 1897 and in the first half of 1898, the smallest number recorded in the history of the American Iron and Steel Association and the smallest number since about 1830. The tendency of the pig iron industry toward consolidation and centralization in the most favored localities explains the complete abandonment of the industry in many States. Notwithstanding the greatly increased production of pig iron in the first half of 1898, the following States made less pig iron in that half year than in the second half of 1897: Massachussetts, Connecticut, New York, New Jersey, Maryland, Virginia, Georgia, Texas, and Tennessee. All the other States increased their production. The greatest increase was made by Pennsylvania, 285,167 tons, and the next greatest by Ohio, 260,024 tons. Illinois increased her production 69,012 tons. Allegheny county, Pa., increased its production in the first half of 1898 only 14,325 tons. The Shenango Valley increased its production 100,954 tons, and the increase in the Mahoning Valley was 96,100 tons.

TOTAL PRODUCTION OF PIG IRON.

States.	Blast Furnaces. In blast Dec. 31, '97	June 30, 1898. In	Out	Total	Production. Gross tons of 2,240 lbs. (Includes spiegeleisen.) First half of 1897.	Second half of 1897.	First half of 1898.
Massachusetts	1	1	2	3	1,702	1,582	1,243
Connecticut	3	1	4	5	3,172	5,164	3,426
New York	4	5	14	19	108,939	134,375	114,114
New Jersey	4	4	6	10	37,863	57,833	54,695
Pennsylvania	76	74	86	160	2,149,252	2,482,382	2,767,549
Maryland	2	3	5	8	80,333	113,369	105,684
Virginia	6	7	20	27	153,472	154,138	126,941
North Carolina			2	2			
Georgia	1	1	3	4	8,141	8,951	7,315
Alabama	19	18	26	44	436,505	511,326	511,848
Texas			4	4	2,604	3,571	1,817
West Virginia	3	3	1	4	53,735	79,172	104,516
Kentucky	3	4	5	9	17,185	18,714	48,730
Tennessee	7	7	12	19	140,431	131,699	130,820
Ohio	33	30	25	55	593,962	778,927	1,038,951
Indiana							
Illinois	15	15	2	17	519,671	597,568	666,580
Michigan	5	6	6	12	61,531	71,047	74,848
Wisconsin	4	2	4	6	29,773	74,136	91,679
Minnesota			1	1			
Missouri	2	1	2	3	5,215	18,668	23,350
Colorado	1	1	2	3		6,582	35,597
Oregon			1	1			
Total, 1897	191	183	233	416	4,403,476	5,249,204	5,909,703

Production according to fuel, in the half year, and the two six months periods preceding, is shown in the next table, together with unsold stocks of bituminous anthracite and charcoal iron at the end of the last four periods of six months:

UNSOLD STOCKS AND PRODUCTION ACCORDING TO FUEL.

Fuel.	Stocks Gross tons of 2,240 lbs. Dec. 31, 1896.	June 30, 1897.	Dec. 31, 1897.	June 30, 1898.	Production. Gross tons of 2,240 lbs. (Includes spiegeleisen.) First half of 1897.	Second half of 1897.	First half of 1898.
Bituminous	383,928	446,114	339,793	289,732	3,804,882	4,659,810	5,127,491
Anthracite	134,687	143,590	106,901	123,848	473,837	458,940	635,209
Charcoal	193,034	237,459	209,795	158,497	124,757	130,454	147,003
Total	711,649	827,163	656,489	571,577	4,403,476	5,249,204	5,909,703

The statistics of unsold stocks of pig iron on June 30, 1898, show a small decrease upon the unsold stocks on Dec. 31, 1897. On June 30 the stocks which were unsold in the hands of manufacturers or their agents, and which were not intended for their own consumption, amounted to 571,577 gross tons, against 656,489 tons on Dec. 31, 1897. These figures do not include pig iron sold and not removed from the furnace bank. The principle decreases in pig iron stocks were in New York, Pennsylvania, Virginia, Ohio, Michigan and Wisconsin. The shrinkage in charcoal stocks alone was 51,298 tons. There was a similar decrease in bituminous stocks but an increase in anthracite.

Included in the stocks of unsold pig iron on hand on June 30, 1898, were 73,241 tons in the yards of the American Pig Iron Storage Warrant Co., which were yet under the control of the makers, the part in these yards not under their control amounting to 184,759 tons, which, added to the 571,577 tons above mentioned, makes a total of 756,336 tons, which were on the market at that date, against a similar total of 874,978 tons on Dec. 31, 1897. The total stocks in the above named warrant yards on June 30, 1898, amounted to 258,000 tons, against 275,800 tons on Dec. 31, 1897. The *Bulletin* adds on this point: "We wish that we could give the statistics of pig iron stocks from year to year with the same satisfaction that we record the statistics of pig iron production. There must always remain an unknown and undetermined quantity of pig iron in the yards of rolling mills, steel works, and foundries which will baffle all efforts to fully indicate the wants of the market at any given period. In semi-annually recording the stocks actually on hand and for sale we do the best that is possible to meet the expectations of the iron trade."

The distribution of stocks of unsold charcoal iron and coke iron is shown in the following table:

STOCKS OF UNSOLD CHARCOAL PIG IRON.

States.	Dec. 31, 1896.	June 30, 1897.	Dec. 31, 1897.	June 30 1898.
New England	7,989	9,073	8,103	5,576
New York	13,280	12,063	8,147	6,819
Pennsylvania	7,129	7,164	7,466	7,212
Maryland	1,544	1,209	2,179	1,475
Va., Ga., and Texas	17,381	9,358	17,170	15,770
Alabama	33,837	27,273	12,591	15,393
Kentucky and Tennessee	13,211	17,458	15,410	13,888
Ohio	13,812	11,796	10,303	8,382
Michigan	64,035	101,603	109,272	71,604
Wisconsin	13,973	24,173	12,939	5,582
Missouri	5,642	5,102	5,028	5,646
Pacific States	1,191	1,187	1,187	1,150
Total	191,034	237,459	209,795	158,497

STOCKS OF UNSOLD COKE PIG IRON.

New York	13,400	39,686	7,749	200
Pennsylvania	100,767	78,541	122,771	96,367
Maryland and Virginia	42,194	66,115	69,489	35,105
Alabama, Georgia, and N. C.	90,703	103,996	44,070	53,277
Kentucky and Tennessee	30,752	50,337	20,144	26,570
Ohio	104,851	107,239	65,935	54,172
Illinois, Wisconsin, and Minn.	1,160			
Missouri and Colorado			9,635	23,541
Total	383,928	446,114	339,793	289,232

The production of spiegeleisen and ferromanganese in the first half of 1898 was 109,641 gross tons, against 80,622 tons in the first half of 1897 and 93,073 tons in the second half.

The production of basic pig iron in the first half of 1898 was 337,485 tons, against 281,610 tons in the first half of 1897 and 274,781 tons in the second half. The production of basic pig iron in the first half of 1897 and the first and second half of 1898, by States, was as follows:

PRODUCTION OF BASIC PIG IRON.

States—Gross tons.	1st half 1897.	2nd half 1897.	1st half 1898.
N. Y. and New Jersey	27,916	51,125	645
Pennsylvania—Allegheny county	139,970	125,578	153,429
Other counties	58,473	36,047	102,318
Maryland, Virginia and Alabama	42,741	54,831	55,534
Ohio, Illinois, Wisconsin and Missouri	12,510	17,210	25,259
Total	281,610	274,781	337,485

The production of Bessemer pig iron in the first half of 1898 was 3,781,314 gross tons, against 2,495,978 tons in the first half of 1897 and 3,299,606 tons in the second half. The Bessemer production by States and in Pennsylvania and Ohio districts is shown in the tables below:

PRODUCTION OF BESSEMER PIG IRON.

States.	Gross tons of 2,240 lbs. 1st half 1897.	2nd half 1897.	1st half 1898.
Pennsylvania	1,503,219	1,931,711	2,053,774
Maryland	58,222	92,883	103,379
West Virginia	53,735	79,172	104,516
Kentucky			
North Carolina			
Ohio	416,782	611,115	839,937
Illinois	461,917	586,074	600,952
Michigan and Wisconsin	2,103	17,069	29,825
Missouri		11,582	48,931
Colorado			
Total	2,495,978	3,299,606	3,781,314

BESSEMER PRODUCTION IN PENNSYLVANIA AND OHIO.

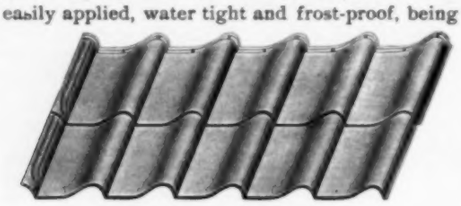
Pennsylvania.	Lehigh Valley	59,718	46,767	38,434
	Schuylkill Valley	32,833	38,390	26,257
	Upper Susquehanna Valley	40,222	51,079	50,444
	Lower Susquehanna Valley	87,956	121,098	182,027
	Juniata Valley			
	Shenango Valley	165,311	287,814	368,815
	Allegheny County	965,219	1,225,384	1,210,249
	Miscellaneous bituminous	151,960	161,179	177,548
Ohio.	Mahoning Valley and H. Rock bit.	155,248	231,270	295,367
	Hocking Valley	2,420		
	Lake Counties	118,304	159,005	213,833
	Miscellaneous bituminous	140,810	220,840	330,737

RAILROAD TRACK DRILL.

A new drill for use in steam and electric railroad construction has been brought out by Boynton & Plummer, Worcester, Mass. It is designated as their No. 2 railroad track drill. Strength and power are the chief characteristics. A balance wheel on each end of the shaft, with the gears, gives a powerful leverage and insures rapid work. The machine is capable of drilling a hole one inch in diameter and one inch deep in three minutes. The hole in the spindle is 41-64ths inch, and either square or taper hole can be furnished. The weight is 410 pounds. One man or two may be employed.

THE BERGER METAL TILES.

Metal shapes for architectural purposes now constitute an important line of manufacture, with the more progressive iron and steel roofing concerns. A particularly attractive specialty in this list is the Spanish tile, manufactured by the Berger Mfg. Co., of Canton, O., and designed to revive the picturesque effect of the old-time roofing. All the advantages of the terra cotta tiles, which have been so much in favor, are secured, and their defects avoided. They are light, easily applied, water tight and frost-proof, being suited



REGULAR 10-TILE PLATE.

to the requirements of a variable climate. They do not break or chip off and require no special roof framing. They are made of copper, galvanized iron, painted steel or tin. The weight is about two-fifths that of slate roofing and one-fourth that of terra cotta tiles, so that heavy roof timbers are not

GRADUATED 10-TILE PLATE.

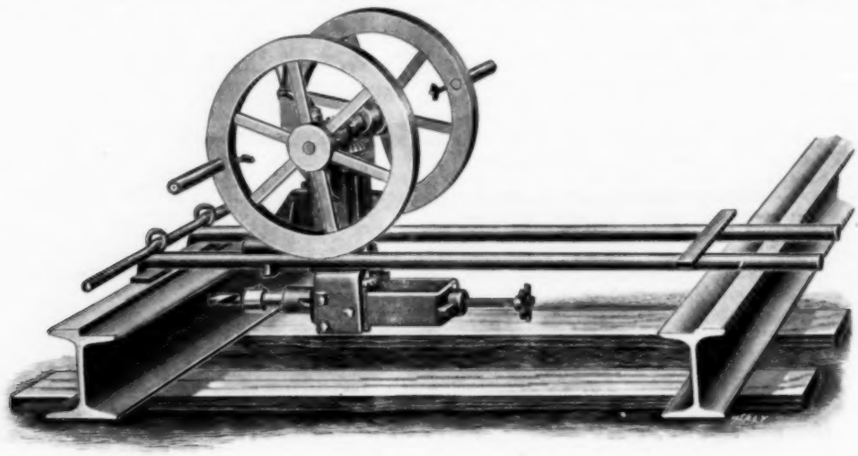
required. The tiles are made with vertical, double side-guard and a double top guard, and the molding is deep. In addition to the regular pattern for straight roofing, these tiles are made in graduated form for towers, turrets and conical surfaces.

THE Chas. L. Bastian Mfg. Co., 76 Illinois st., Chicago, report that the usual "summer dullness," which almost always commences in June, has not yet put in an appearance, and while business is hardly as good a sit was two months ago, it is still much better than ever before at this season of the year.

A ROD MILL FOR BIRMINGHAM.

Important propositions are connected with a trip of Chicago iron and steel men to Birmingham, Ala., early in the present week. On Monday, July 25, President Milton Smith, of the Louisville & Nashville Road arrived in Birmingham accompanied by the following gentlemen, who traveled as his guests: President John W. Gates, 1st Vice-President C. H. Foote and General Engineer W. H. Harper, of the Illinois Steel Co.; President John Lambert, 2d Vice-President Isaac L. Elwood, General Counsel E. H. Gary, of the American Steel & Wire Co.; General Manager W. I. Babcock, of the Chicago Ship-Building Co., and Gov. Tanner, of Illinois.

The trip was made at the invitation of representatives of the new steel company whose plant is now under way at Ensley City, four miles from Birmingham. Judge Gary made the statement that the party was investigating the feasibility of erecting a rod and wire mill at Ensley and that it was entirely probable such a move would be made. It was stated



NO. 2 RAILROAD TRACK DRILL.

that the decision of the matter by the American Steel & Wire Co. depended upon the sort of proposition the Birmingham interests made. President Gates named 350 tons of billtets a day as the probable requirements of the proposed industry. The proposition that will be made will include a favorable price on steel, a site for the new works and railroad concessions. The Chicago party also visited Mobile and Pensacola. It is the intention, in case a Southern plant is built by the American Steel & Wire Co., to send a large part of its product abroad.

MANAGER R. Bertrand, of the Kladno Steel & Iron Works, in Bohemian Austria; Manager A. von Kerpely, of the Alpine Iron & Steel Works, of Vienna, and Herr F. Schneefuss, manager of the great plate mill of Teplitz, in Bohemia, are making a tour of the steel works centers of the United States. They sail on the Fürst Bismarck this week. For the past two months they have been inspecting plants in England and the United States. Manager Kerpely has made a number of important contributions to the proceedings of the Iron and Steel Institute.

THE Mutual Electric Co., a new corporation, has opened offices at 1218-1219 Marquette Bldg., Chicago, where it will conduct a general electrical constructing business, including residence, theater, hotel, and factory wiring, the installation of isolated and central station power and lighting plants, and the construction of electrical railroads. The officers of the company are E. H. Cheney, for six years with the Chicago Edison Co., and F. S. Richmond, who has been in the same business in Chicago for a number of years.

THE production of Bessemer pig iron in Allegheny county in the first half of 1898 was 1,210,249 gross tons, against 965,215 tons in the first half and 1,225,384 tons in the second half of 1897. In the Shenango valley the Bessemer iron output was 368,815 tons in the first half of 1898, as compared with 165,311 and 287,814 tons respectively in the first and second six months of last year. The Mahoning Valley and Hanging Rock districts together produced 295,367 tons, against 1,555,248 tons in the first half and 231,270 tons in the second half of 1897.

Review of the Technical Press.

BY DR. RICHARD MOLDENKE.

Commercial Methods of Testing Iron and Steel. [*Journal of the Franklin Institute*, June.]—Mr. P. Kreuzpointner's recent and much discussed lecture before the Franklin Institute on the practical aspect of present commercial methods of testing iron and steel, has just been published in the Journal of the Institute. Mr. Kreuzpointner opens up with a brief resumé of the conditions governing the steady trend of our well organized industries in the direction of economical and exact methods. The vast interests of a nation such as ours are gradually forcing home a recognition of the vital importance of its political economy. Even in a smaller sphere, such as that of a blast furnace plant, the niceties of a well balanced management, combined with thoroughly scientific methods of adapting the resources available to the best ends, are at present the only means of a profitable existence. The closeness of the limits of running cost now allowable, combined with the natural tendency to maltreat the product, when working under such conditions, in order to get it out quickly and cheaply, has made it necessary to devise strict methods of proving the quality of the material produced. Again there is the desire on the part of the purchaser to get the best grade of material for the money available, which also works in this direction. Mr. Kreuzpointner stakes even higher ground when he states that "the economic necessity of using the least permissable quantity of a metal of approved quality has created an increased demand for more or less elaborate systems of testing, inspecting, and analysing materials of construction." Now in order that our methods of testing the materials used may be proper and reliable, we must first be familiar with their behavior under strain. For if this is not the case the methods resorted to in testing will be at least unsuitable, and consequently the waste necessary by reason of large factors of safety reacts upon the commercial side of the undertaking, and a much higher first and possibly running cost will be the result. As the knowledge we have regarding the behavior of the materials of construction is by no means what we would wish it were, the methods of testing are consequently still in a state of evolution. Unless the methods are in strict accord with the nature of the metal the tests are worthless.

Mr. Kreuzpointner next discusses the constitution of metals in general. Thus as all metals are more or less viscous bodies, the aim of the test should be to measure the degree of viscosity as accurately as possible. Now this question of viscosity is a complex one, and opinions are by no means uniform for many natural causes, every man viewing the question from his own standpoint. Yet so much seems to be admitted, that the tensile test is considered as the most important one any metal can be subjected to, while a bending or nicking test shows up the structure of a bar much better than the tensile test; yet it is essential that the observer be a trained expert in methods of manufacture, otherwise his judgment will be practically worthless. The tensile test eliminates most of the personal equation in the matter and gives the engineer definite figures to work with. In studying the tensile test we must have recourse to a branch of science called molecular physics. Thus if the strain is applied, it is conceivable that the crystals are brought into closer contact. If this strain is not enough to cause a sliding of the crystals upon each other, and is now removed, the crystals spring back to their original position, this constituting the elasticity of the metal. Let the strain be so great that sliding does take place, and a deformation takes place, then upon release the crystals do not spring back quite so far, and we have a permanent set. Keep up the strain and the material will begin to flow visibly, or in other words the viscosity comes into play. The final result is rupture. The structure of the metal of course has much to do with the effects produced, the soft portions of a steel will naturally compress first; the harder ones yield later on. The question of viscosity gives rise to a misconception of the true elastic limit, or limit of proportionality as it is sometimes called. Unless one is expert in finding this true elastic limit, as distinguished from the apparent elastic limit taken at the drop of the beam of the testing machine, an error of several thousand pounds too much will be the result. Mr. Kreuzpointner gives several examples of this kind. While the finding of the true elastic limit is a very tedious piece of work and is therefore seldom attempted, yet it is the real turning point between the known conditions of a metal, upon which the engineer bases his calculations, and the unknown conditions which we are all trying our utmost to keep away from the structure. A much closer study of this point with a view to adapting it to everyday use would seem, therefore, to be in order.

The percentage of elongation of a test piece is a practical and reliable measure of the elasticity of iron and steel. The more plastic a metal is the more it will stretch. It has been found, however, that improperly proportioned test pieces have a retarding influence, and hence vitiate the real value of the test, for free play must be given to the viscous action of a metal while under the test. The 8-inch section (in length) seems, however, to fulfill all the requirements of the test, and the present method is therefore eminently satisfactory as a measure of the ductility of iron and steel. The reduction in area is not what it should be as a test. In stretching, every particle of the metal under test is supposed to yield and flow to its utmost capacity, until finally the cohesive forces are overcome and the metal parts. Now if the particles of the metal were all uniform, would flow uniformly, and finally all break at once, the contracted area might do as a measure of the strength of the piece. Unfortunately this is not the case, and the contracted area usually represents some local weakness which made the piece break just there. While the elongation is the result of a stretching of every particle of the metal, the reduction in area is a consequence of a contraction only at the point where the piece has broken. The longer the test section, therefore, the less representative will be the reduction in area as a quality measure. Iron and steel being subjected to shock to a considerable extent in practice, the drop test forms a very important item in their valuation. While under the tensile test the particles have time to adjust themselves, this is not the case under sudden shock. Here every particle is put on its own merits. If the cohesion is weak the particles will separate easily, hence irregularities in structure, flaws, even if microscopic, etc., will cause a separation very quickly, and the fracture will be from inward out. A shock must be transmitted quickly throughout the whole mass, for if a flaw arrests the vibrations, the crystals will separate quickly and failure will result. A test with a very heavy drop is therefore a very practical one. If the drop is too light, a continuation of the blows to produce fracture will result in heating the piece, and hence give unreliable results. Nicking the bar and breaking quickly shows its internal structure. To the trained eye it will also show the treatment the piece has undergone during manufacture.

The bending test is also quite reliable, for if a soft steel cannot be doubled up without showing cracks, it must be a very poor material. With harder steels, it shows to what degree the cohesive power between the hard crystals in the soft matrix is in existence. The nick bending test, which means that a metal is first nicked and then bent upon itself, shows up a good piece of iron or steel very quickly, for this is a most severe test, the nick separating the crystals on the surface being very apt to start a crack which will grow. Quenching tests are of a doubtful value, for unless uniformity in making the tests is especially looked after, the results are not comparable. What, for instance, is the real meaning of "cherry red" or "blood heat?" Transverse tests are usually applied to cast iron, the small degree of viscosity found in this metal, overbalanced greatly as it is by its rigidity, makes this a very convenient method of testing. Again, the transverse test on cast iron shows by the deflection produced that there is some elongation in the piece not ordinarily observable in the tensile test. The casting strains, so-called, are also present and influence all tests of cast iron. Mr. Kreuzpointner mentions a number of other tests, such as crushing, shearing, punching, drifting, and fatigue tests, and concludes with a brief review of the aspect of the microstructure of iron and steel, also making a strong plea for hearty co-operation with the aims and objects of the International Society for Testing Materials.

AT the Pennsylvania Steel Co.'s works at Steelton, Pa., the number of employes is 1,800 greater than that of a year ago.

THE WESTERN FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Western Foundrymen's Association was held Wednesday, July 20, at 7:30 P. M., at the Great Northern Hotel, Chicago, with President G. H. Carver in the chair. The following were present: G. H. Carver, Plano Mfg. Co., West Pullman, Ill.; F. M. Lyon, Burlington Route Foundry, Aurora, Ill.; E. H. Walker, J. I. Case T. M. Co., Racine, Wis.; E. E. Walcott, Bates Machine Co., Joliet, Ill.; F. G. Coffeen, Deering Harvester Co.; E. E. Hanna, Gates Iron Works; W. A. Jones, W. A Jones Foundry & Machine Co.; A. M. Thompson, Link Belt Machine Co.; Geo. W. Cope, *Iron Age;* H. S. Vrooman; A. W. Bodell; P. D. Sloan, Garden City Sand Co.; R. M. Dyer, Aueromotor Co.; B. Orbison, Fraser & Chalmers, J. H. Dalton, Walborn-Swenson Co., B. M. Gardner, *The Iron Trade Review*, all of Chicago.

The minutes of the last regular meeting were approved as published.

Discussion on Trolley Systems.

The paper entitled "Trolley Systems in the Foundry," by Herbert M. Ramp, published in our issue of June 30, and read at the Cincinnati convention of the American Foundrymen's Association, was read by the secretary, as its discussion was appointed for the meeting.

Mr. Coffeen: We use the overhead trolley system in our gray iron foundry, but I am a little bit at loss to give its comparative value, because I never have used on the same class of work any other system. However, from what I could learn from men who used the old track system, especially for distributing the iron, there is a remarkable gain in the use of the plan and we have very little trouble with it. I have heard some criticism on the system concerning the trouble with the switches and the trolley. We have very little now. Whether that is the result of long experience in the management of the system or not, I cannot say. On a good many of the floors for anything like large work we use a kind of overhead crane and pneumatic hoists. I suppose they are more like a sort of trolley system. They make the work very fast on that class of work.

Mr. Carver: Can you describe in detail the system, whether it is used direct to pour off the molds, or simply as a method of carrying the gross weight to some convenient distributing point?

Mr. Coffeen: That depends on the work. Where the work is large enough to use a truck of iron, that is, 1,200 pounds and up, we use a crane for pouring, running across the floor and pouring right in the truck. We have some smaller cranes, hung from a trolley; the crane swings below. These are for lighter work, but they don't work so well. Such work as mower wheels and mower frames and the old style binder wheels, we pour from the crane. All the iron is carried on this trolley system to the floors and some of the castings are carried out on that. It is not arranged now so that we can get castings out and get the iron around at the same time, so we take the iron out at on a wheelbarrow and handle the larger part of it that way.

Mr. Thompson. If the trolley system means, as I understand it, the running of a trolley on a single rail, and is thereby limited to the direction in which it will travel, I think the traveling air hoist, which has a movement in every direction, limited to the span of the crane and the length of the track is better. I think a system of that kind can be put up in most any shop, no matter how low the roof is, and cover more ground to a good deal more advantage than a single rail system would. In regard to the handling of material from one department to another, I don't think there is anything can beat the surface track for that purpose. For handling castings from the foundry to the machine shop, for instance, a track with trucks will take a larger load of castings than can be handled on a trolley. It would appear to me that the amount of material that could be transferred that way would be qufte limited. A load of castings may comprise several hundred pieces and these can be far easier handled by a truck than on anything which would be hung upon a single trolley track About taking flasks to the yard: I think a surface track running past the end of each molder's floor, with the necessary turn-tables in the yard, will carry out more flasks in a given time and distribute them in different places in the yard than any trolley system. With the latter they would have to be re-loaded on trucks after they got to the end of the foundry to go out in the yard, which would necessitate double handling. If we compare the trolley system with the old style of circle cranes, it is certainly far ahead of them, saving a great deal of space; but I believe that the air hoist cranes, which can be made to span from 10 to 20 or 30 feet are superior to a single track trolley system.

Mr. Orbison: I have seen the trolley system in several foundries, in fact have worked at places where they have had trolley systems, but where they handled a lighter class of work. I do not think it would be practicable at all to handle a heavy class of work and I agree with Mr. Thompson in that respect, that there is nothing like the surface track. Where they make light work, bench molding, etc., for distributing the iron it is a very good thing; but I never knew it to be for anything else but distributing, when it is handled by hand for the different floors.

Mr. Gardner: Mr. Ramp says: "Formerly when an engine or boiler was to be loaded, or any machinery or castings, it was accomplished by hand. Now it is run under the trolley track on a truck, and four or five ton loads are picked up and loaded on the cars by two men in almost as few minutes."

Mr. Orbison: That is for loading; that is all right, I don't question that. But I can't see where the advantages to be gained are; the system certainly can't be put to any work other than the distributing of the metal, and you still have to do the pouring by hand—that is, the major portion of it. There might be certain molds that could be passed along the track and poured from the trolley. Outside of that, it could not be utilized unless by a series of switches. I have never seen the trolley system constructed, any other than on a double track, one track for out-going and one for incoming ladles. Those I have seen were used for continuous pouring.

Mr. Thompson: It would appear to me that a single track trolley system, in an agricultural shop, for instance, where they put up mower wheels on every foot of ground for a space of probably 30x50 or 30x100 feet, and do the necessary lifting, that would require a perfect network of tracks and switches, which would be more expensive than a single span crane of light construction, with rails necessary to support it for the distance of the floor. I think the flasks could be handled quicker, as the hoists can be moved over the flasks without having to go back and forth to switches

Mr. Carver: Mr. Thompson, has not your firm recently equipped a large agricultural foundry with the trolley system?

Mr. Thompson: No, we equipped them with the sand handling system, but I believe the Whiting Foundry Equipment Co. equipped them with an air hoist system and light traveling cranes, which cover the entire area of floor space.

Mr. Walker: I am a firm advocate of trolley systems in a foundry. Some three or four years ago, I had the privilege of going through the Walter A. Wood foundry in Hoosick Falls, New York. They used to run their iron on trucks on tracks. They have thrown them out completely and put in a douflle track overhead system. On their side floors, they took the overhead traveler and suspended to them air-hoists. The overhead track that ran down the center delivered the iron to the side floors and the side floors carried ladles of their own. The ladle delivering the iron delivered it into the ladle on the side floor swung from the crane; the crane picked it up and moved it on until on the side floor they poured it off, doing away with helpers to help carry out the iron, shaking out their own molds and piling up their flasks; where it took half dozen men to wait on the molders before, one and two men do it and do the most of it at night. At night a few men took the castings out and carried them to the cleaning room; a track ran into the cleaning room and switched off down the line of barrels and left all the castings right at the barrels where they were to be milled. This overhead system passed over overhead scales; there sat a man and took the weights. They went into their machine room and were delivered at the machines; when the machine work was done on them, they were taken from the machines to the setting up departments on the same system. They were then taken as finished machines and put into the warehouse. It would be surprising to

anybody to go into that foundry to see the small amount of laborers' service that was required. They cut out, they claim, fully one-half of the laborers, and did the work with this overhead system. I was so much impressed with it that I came back to Rockford, where I was with the Emerson Mfg. Co. then, and installed it on a small scale there. I didn't have an overhead traveler, as we found the work could be lifted without the aid of it, but I used it in distributing the iron. I found we could put jobs on the bench that practically were made on the floors before and carried on with small bull ladles. These were delivered with the trolley ladle by carrying the length of the floor. With the truck systems, nine cases out of ten you stopped at a given point, and delivered iron around to six or eight floors. With this overhead system of delivery, the iron was delivered direct to the floors and a man did not move from the head of his floor at all, but stood there and took his iron as it came along. I now have charge of the J. I. Case foundry, at Racine. I am going to install the overhead system. It is not as heavy work as some, running anywhere from five pounds up to 2,500 and 2,000 lb. castings, down to little light snap work on separators. But I see no reason why the overhead system delivering iron to the floors with the overhead traveler and air hoist cannot handle iron and castings weighing anywhere from 10 lbs. to 2,000 or 3,000 and do it quicker and easier and save labor. Mr. Ramp says, the saving is 50 per cent in some cases, 30 per cent in others and 10 per cent in others; it depends altogether on what you have got to handle. I am so firm a believer in the overhead system, that we are going to put it in and expect to pay for it in a very short time.

Mr. Thompson: I would like to ask Mr. Walker if he refers to a traveling crane.

Mr. Walker: By overhead traveler, Mr. President, we mean a traveling crane. They cover the space of possibly two floors and from that overhead traveler hangs an air hoist. I would give more for one of the air hoists on a light traveler than I would for two cranes.

Mr. Thompson: Have the travelers a 20 or 30 foot span?

Mr. Walker: The width of the girder; I could not say whether it is 15 or 18 feet. I will say, for handling molds, in handling iron anywhere from five lbs. up to 1,500 or 2,000 lbs., I consider the overhead system is unapproached.

Mr. Dyer: I will not say I am inexperienced in the use of the trolley system, but I am out for information with reference to it because we think we probably can save considerable labor by handling some of our material by an overhead traveler, which Mr. Walker has described. I don't know as it would be any advantage in a single track, one track going from the cupola and returning at the side some distance from it. I don't believe there would be any advantage in such a track over our floor tracks. In our work, we have 800 to 1,000 pairs of iron flasks which are being handled at night and the breakage is quite an item. We have in mind the use of an overhead traveler with an air hoist on it for handling these flasks and stacking them up. I don't think we would at once discard our floor tracks for carrying the iron, but possibly we would. It has given us very satisfactory results. If anyone can give me any information, or if I can find any information in reference to handling the iron flasks such as we use and cleaning up the floor at night, possibly getting the castings out on the trucks, I would consider it good information. The arrangement of our factory would prevent us from carrying the trolley system into the shop, probably. I don't know whether it would entirely prevent it or not; but we run up five stories and for that reason we thought that tracks were the easiest thing to handle in the factory. But we had in mind, as I say, the use of the pneumatic hoists on an overhead traveler in the foundry and I am anxious to see some in operation and hear from those who have them in operation.

Mr. Coffeen: In part of our work we use the overhead traveler and pneumatic hoist for shaking out, but those are on the heaviest flasks on the mower frames. I don't know about the breakage of flasks. I don't think we break a very large number of those flasks; we use iron flasks.

Mr. Jones: I have never operated a foundry in which we had an overhead system otherwise than a traveling crane or a series of light overhead travelers, which I think possibly may be referred to in this article. So far as removing the flasks and taking the castings out of the foundry, a system would have to be very good indeed to supplant a narrow gauge railroad through the concern. I have examined pretty carefully the working of the trolley system in the Sargent Co.'s works, that is the gray iron department, and if I am not very greatly mistaken, they pour all of their brake shoes direct from the single trolley rail. When I say single, I mean the right and left of outgoing and incoming trolley. They no doubt make a success of it; they handle a great deal of iron and handle it very rapidly; handle their flasks with it, a great many of them, though not all of them. Personally, I have had no experience with the overhead trolley system.

Mr. Dalton: We have electric cranes in our plant; we handle everything by electricity. The Atlas Engine Works, I think, have a very complete trolley system, and pour everything by trolley. The taking out of castings and the handling of flasks depend a great deal on the location of your chipping room. The arrangement of our chipping room is such that it is between the machine shop and foundry. Our cranes run from one place to the other, take our castings into the chipping shop.

Discussion on Inspection of Castings.

A paper entitled "Inspection of Castings," by E. H. Putnam, was then read. This was read at the Cincinnati convention of the American Foundrymen's Association, and appeared in our issue of June 23.

Mr. Carver: In one of our leading agricultural works, I understand it is the practice with certain kinds of castings, such as mower wheels, to make them and stack them up out in the foundry yard, sometimes for one or two months before they are tumbled and given any chance for inspection. I would like to know what foundrymen think of that plan in the light of this paper read here urging more prompt action.

Mr. Walker: You spoke of some founders packing mower wheels out in the yard for a certain length of time without cleaning; circumstances might compel them to do that, still I should think that would hardly do if they are being made by the piece. We all find it very hard to come back onto a moulder after a casting is a few days old for the making of it, for there is always a question as to whether he made it or did not make it. All inspection I have anything to do with is done almost immediately as soon as they are cleaned. This paper speaks of laying out the whole floor. I should think that hardly practicable; for castings go through a certain process, are turned over to the grinder and shippers and we are supposed to have men of intelligence enough to know when they run across a bad casting and throw it out. We always lay the bad work out; every day's product has inspection and all that goes through is supposed to be good and that is the last we hear from it.

The meeting then adjourned to the third Wednesday in September.

An abstract of a lecture on "Mechanical Draft for Steam Boilers," delivered before the Sibley College, by Walter B. Snow, of the engineering staff of the B. F. Sturtevant Co., Boston, has been reproduced in pamphlet form. In a concluding paragraph the author presents the case thus: "Briefly summarized, mechanical draft is capable of reducing the avoidable losses, of decreasing the first cost of steam generating plant, and of reducing the fuel expense. In addition, it presents certain marked conveniences in the matter of installation and operation. In these days when every step in the process of steam generation and ulilization is being scrutinized, in the attempt to reduce the cost by even a single per cent, the opportunity presented by the employment of mechanical draft cannot be and is not overlooked. The economical necessity was not so imperative when Rankine and Clark pointed to its marked advantages. And the future was but dimly discerned when, only 15 years ago, Seaton referred to the chimney as a rough and ready, but exceedingly wasteful way of inducing the air to flow into furnaces with sufficient velocity to cause the fuel to burn, and prophesied that it would some day undoubtedly be superseded by a more scientific and economical apparatus."

The Howard-Harrison Iron Co., Bessemer, Ala., has given notice of dissolution in view of the company's recent absorption in the Southern pipe consolidation.

MICRO-STRUCTURE OF IRON AND STEEL.*—I.

BY S. S. KNIGHT.

Since systems of testing have become so numerous and so many are possessed of such seeming merit, engineers and constructors have been forced to pause a moment before closing the specifications that they are drawing up and give attention to what means shall be used to determine whether the purchased product shall have the desired properties.

It has long been felt, in the world of iron and steel manufacture, that the time-honored tests for fiber-stress, tensile strength, elongation under load and the determination of the elastic limit were not sufficient to insure the acquisition of material to meet special requirements, hence the foremost investigators turned with enthusiasm to the chemical laboratory as a means of supplementing the tests before mentioned. It is needless to add that even here they were somewhat disappointed, as in the case of the carbon compounds of steel, the science of chemistry could not make a distinction between the ordinary cement carbon and that so familiarly known as hardening carbon. As an example, let us consider a steel rod which for convenience we will analyze and cut into two pieces. One part we will call A and the other B. The analysis showed that this rod contained .340 per cent carbon which, of course, was all combined; the phosphorus was .106 per cent and the manganese .553 per cent. A was placed in a furnace and heated to a moderate redness or 700 degrees centigrade, while B was heated to about 1,200 degrees. Both were thrown upon the ground and allowed to cool slowly. They were then taken and submitted to a strain of 45,000 pounds, each piece thus strained being eight inches long The original diameter of the rod was nine-sixteenths of an inch. Under the stress, A elongated .65 inch and B but .13 inch, or one-fifth as much as A. A subsequent analysis showed that the carbon content had not changed and the Eggertz method could make no distinction in regard to the compounds of this element with the iron in the two bars.

This case only shows how limited were the advantages to be derived from the possession of chemical facilities, and although they are of far more value at the present time than they were one year ago, yet the science has not been perfected to such an extent that its exponents need feel any alarming gratification when it comes to distinguishing between the various compounds of carbon and iron. Even if it were able to do this, it could only give us the composition of the material from a chemical standpoint, so that the discovery of what processes it was submitted to in its manufacture would still come under the domain of some other science. Hence engineers, who had so often found faulty steel of the correct chemical composition, but wholly lacking in those physical properties which had been so commonly found in similar stock, and which had been so particularly desired in the material in question, turned with a new zeal to the recently discovered process of determining the mechanical properties of steels by a system of mechanical analysis. It is this new departure with which we have to deal to-day and which we shall proceed to investigate.

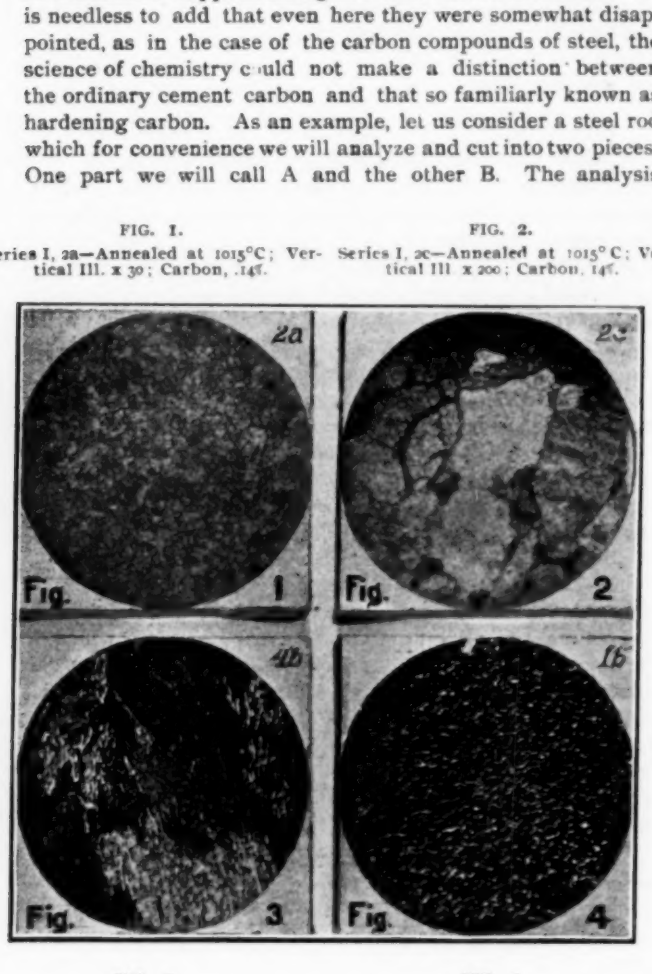
We have called this new method a system of mechanical analysis, and it may be interesting to know that this was the identical terminology used by its inventor, Dr. Sorby. The very name leads those interested to suppose that, like other mechanical and unlike chemical means of testing, this system would become popular since its name made the uninitiated to suppose that it was free from scientific terms. As usual, such was far from the case, and the doctor's system of testing by reading or studying the fractures of metals with the naked eye or low power magnifying glasses soon grew into science with a terminology of its own, and in place of the simple magnifying glass came the compound microscope.

FIG. 1.
Series I, 2a—Annealed at 1015°C; Vertical Ill. x 30; Carbon, .14%.

FIG. 2.
Series I, 2c—Annealed at 1015° C; Vertical Ill x 200; Carbon, 14%.

FIG. 5.
Series IV, 1b—Showing Cementite; x 10; Blister Steel.

FIG. 6.
Series IV, 2b—Details of Cementite; x 60; Blister Steel.



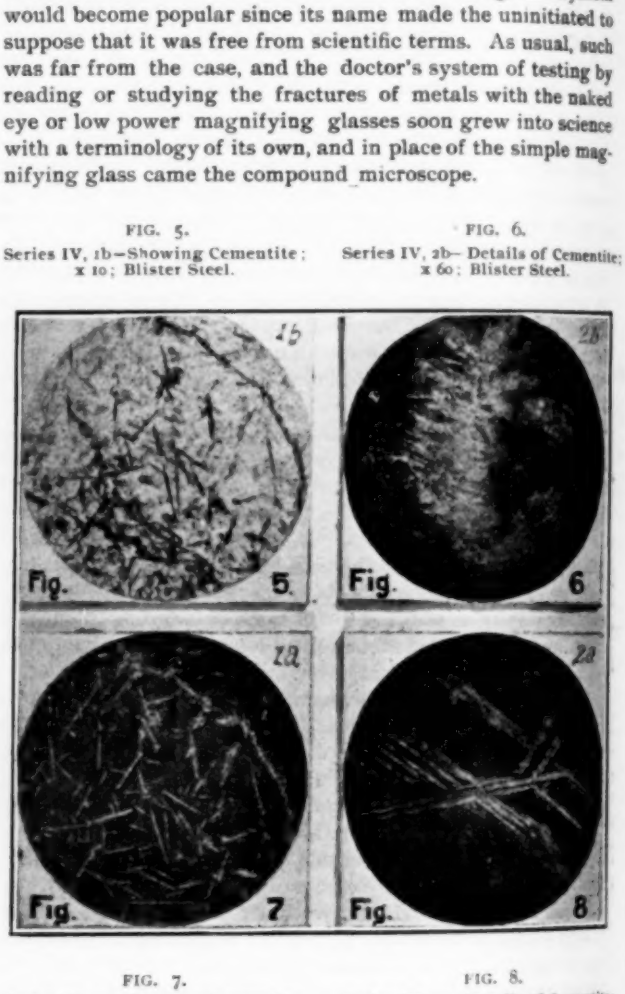


FIG. 3.
Series I, 4b—Annealed at 1360° C; Oblique Ill. x 30; Carbon, 14%.

FIG. 4.
Series I, 1b—Hammered; Oblique Ill. x 30; Carbon, 14%.

FIG. 7.
Series IV, 1a—Showing Cementite; x 10; Blister Steel.

FIG. 8.
Series IV, 2a—Details of Cementite; x 60; Blister Steel.

Let us note before going further that the difficulty of performing a test will detract nothing from its intrinsic merit. It may, however, and quite often will so limit its field of actual utility that ofttimes where it could be used to the best advantage, it will be dispensed with solely because it is of such a nature that it is inconvenient to perform. This difficulty may arise from either of two causes or from a concurrence of both; first, the necessity of possessing costly apparatus, and second, the requirement of specific knowledge or obscure technique.

It is probable that no test has ever been devised in any class of work which possessed both of these difficulties in so marked a degree as that with which we have to deal in the present case.

To the unobserving it may have appeared that iron, and more particularly steel, is nearly homogeneous. Homogeneity is of two distinct kinds, which we may loosely call molecular and molar, or, more properly, chemical and mechanical. It must be kept in mind, however, that the presence of one in no way indicates or necessitates the presence or absence of the other. Thus two pieces of carbon might, in some manner, be held together, which hypothesis would necessarily make them chemically homogeneous, and yet one might be a brilliant, glittering diamond while the other was but a shapeless lump of black graphite. In this case one would be crys-

*Read at the Cincinnati meeting (June, 1898,) of the American Foundrymen's Association.

talline and the other perfectly amorphous. Happily, however, for the investigator, this latter condition cannot exist among metals, since crystalline forces on one hand and strains of tension and compression on the other, superinduced by a dissimilarity of thermal conditions, give rise to definite geometrical elements of physical constitution in every metal. According to Osmond, "these elements may, moreover, assume perfect crystalline forms, with their planes of cleavage well defined and highly distinct; or embryonic crystalline forms, segregated in the midst of a conglomeration of confused organization, which is the more common case, or pseudo-crystalline forms of expansion and contraction like those produced by the drying of gelatinous precipitates (as most frequently seen), all of these different forms associated.

You grasp at once the magnitude of the field to be covered by the science which uses the microscope in interpreting the surfaces and fractures of metals. In fact, the entire science of metallography has grown exclusively out of the study of fractures and the desire to correctly read them. The science is young, is but a thing of yesterday, and although we do not know what it embraces in its scope, nor can we predict what its future will be, yet we can say with absolute certainty what advantages may be obtained from its use to-day.

It is not necessary to consume your time with a history of this science; it will be sufficient to say that Dr. Sorby was its founder, and that under the influence of his writings and works it has grown to such an extent that where its originator was able to use but nine or ten diameters of magnifying power upon his specimens, the exponents of his system to-day can use upwards of one thousand diameters with excellent results. This rapid progress has been due, in a great measure, to the untiring efforts of Messrs. Martens, Osmond and a score or more of others. Like most sciences, it started in the laboratory, and has steadily grown and extended until we find it used to-day as a supplement to chemical analysis and physical testing in every country upon the globe having large metallurgical interests.

We would not wish to assume the criterion of speaking for American metallurgists, but a quotation from Prof. Stillman, who is an acknowledged authority on all questions pertaining to engineering, will show in what high regard he holds this science. He says, in part, "Microscopic examinations of iron have led to remarkable developments of our knowledge of its structure." Recent investigations have shown that eminently practical results are to be obtained from microscopic examinations.

As an illustration of its commercial value, let a discovery made by one of the foremost German microscopists of to-day be considered.

Baron von Juipter, while studying the deterioration of steel rails in actual service, found that before the complete annihilation of the structure obtained by heating and working took place, or coincident with it, the end of the rail bolted between the fish plates would begin to show microscopic cracks or fissures. Further study of this phenomenon proved that the original structure could be restored by simply giving the rail proper thermal treatment. It will be understood that to accomplish this end no rolling or mechanical operation would be required, the proper degree of heat correctly applied fully attaining this end.

It had long been known that in iron in the refined state or as steel at least two mechanically different substances existed. These were supposed to be pure iron and iron in combination with carbon. This old theory was true enough for steels without temper or those that had never been subjected to heat treatment. As more attention was given to steel and its behavior under various conditions, some startling facts were discovered. As regards our present topic, it will be sufficient to note but two of these.

The first is that when any steel that is rich in carbon is slowly heated by any constant source of heat, the temperature rises uniformly or as the length of time that the heat is applied, until a point in low redness is reached (680 to 720 degrees centigrade), when the material ceases to continue to uniformly increase in temperature and remains for an appreciable time the same color. After a time the temperature continues to rise uniformly again as if no disturbing influence had been felt. This it may do until liquifaction takes place, but usually lesser retardations occur as the temperature rises. In cooling the opposite phenomenon takes place, the color gradually leaving the steel until the same point is reached, when the metal assumes a sharp and distinct glow, which soon subsides and the cooling continues in the previously described manner. These points where the retardations take place are called the W and V points by Howe, and are designated by Osmond as Ar, or in cooling the points of recalorescence.

Without entering too deeply into the character of this phenomenon, we may assume that the only retardation that takes place occurs at the W or V point, although, as just shown, such is not the case. Osmond explained this phenomenon by asserting that the change which took place was from the ordinary iron to a special hypothetical, allotropic form, which change, of course, consumed heat, hence the retardation. As it was known that a sample quenched from a higher temperature than this point would be greatly hardened, Osmond gave this allotropic form of iron a property of increased hardness and claimed that the quenching did not allow a sufficient time for the iron in this hypothetical state to change back to iron in the ordinary state. It was also known that the increase in hardening, due to quenching, was roughly proportionate to the amount of carbon that the steel contained, but this was reconciled to this theory on the supposition that the carbon clogged the action or change from one form of iron to the other.

This same phenomenon explained from a microscopic examination would be very simple and, above all, would rely solely upon observed and known facts, instead of wholly upon an hypothesis that from its very nature could never be verified. The retardation would be seen to be due to the changing of composition which takes place in the carbon when it is subjected to a heat greater than 700 degrees C.

The process of preparation for this examination would consist in making a button from the stock which is to be quenched and also one from the same material after it has undergone this operation. These buttons are sections of ½ inch thickness and any convenient diameter. After being turned out on a lathe they are mounted upon a glass slide such as is used for ordinary microscopic work and then placed in a chuck which securely holds them. The surface is then ground off on an emery wheel, finer and finer wheels being used as the operation proceeds. The surface is then polished with emery flour, calcium carbonate, and lastly with washed rouge.

Under the microscope these buttons will show two entirely different structures. The first will show pure iron, which is known as ferrite, and some of the many compounds of iron and carbon. This ferrite may be seen nearly pure in malleable castings. When relief polished it retains a dull polish, but becomes massive as the process is continued; this appearance fades away and it becomes granular, sometimes resolving into the massive structure again under higher magnifications.

No. 1 shows the granular structure of ferrite and is a sample of .14 per cent carbon steel which was annealed at 1,015 degrees C. No. 2 shows the massive structure above referred to under higher magnifications, the ferrite being in the form of large polyhedral crystals and the specimen being No. 1 magnified 66 times more than as shown before. The illumination in both cases was vertical. No. 3 shows the same steel annealed at 1,300 degrees C. under oblique illumination. The dark portions are those protected from the light by the irregularities of the surface. No. 4 is the same steel hammered, the illumination being also vertical. The granular structure is especially worthy of notice. This ferrite remains uncolored when etch polished with calcium carbonate or when etched with tincture of iodine.

Besides the ferrite just spoken of, four other distinct forms are known to microscopists. All of these are in a greater or less extent compounds of carbon and iron. The most commonly seen of these is the variety known as cementite, which is supposed to be a carbide of iron of the formula Fe_3C. It was formerly supposed to be the hardest of all the compounds of carbon and iron, having a hardness about equal to that of felspar. It is believed to be identical with the hard components of both cast and forged steels. Like ferrite, it remains uncolored when etched with tincture of iodine. The appearance of this constituent is often very deceptive, and its tendency to appear as scratches or fissures is likely to lead the neophyte astray. No. 5 shows a portion of a button of blister steel, which will at a glance show the appearance of which mention was just made. No. 6 shows a portion of the same field shown by its immediate predecessor, the magnifying power having been increased ten times. The detail of the supposed scratch is clearly shown, the illumination in both cases being vertical. It will be seen that the beginner would be apt to take the appearance just spoken of as an evidence of the incompletion of the polishing process. Such, however, is not the case and is a strong point in favor of the frequent inspection of the sample while being ground. No. 7 and No. 8 are also specimens of stock similar to No. 5 and No. 6, the cementite being shown in detail in the latter. It will be noted that what appeared as a cloud in No. 6 appears as distinct structure in No. 8. Also notice the regularity of the various angles formed by the intersection of the monoclynic needles. In all of the last four specimens shown, the homogeneous structure of the ferrite or matrix in which the cementite lay, is a point worthy of attention.

[Concluded in next issue.]

MANAGEMENT OF BLAST FURNACES.*—II.

BY E. S. COOK, POTTSTOWN, PA.

Ores of the same oxidation, belonging to the same class chemically and of essentially the same analysis and physical structure, vary greatly as to their working qualities and their practical value. One may part with its oxygen freely. Another may hold it very tenaciously. Why this is so I do not know, but it is a fact that influences the consumption of fuel per ton of iron more than the uninitiated would imagine. By burden is meant the pounds of ore that one pound of fuel will carry, that is, deoxidize and melt, converting it into pig iron. The burden is affected by this quality existing in ores, the difference between the burden at 1.5 lbs. of ore and 1.75 lbs. the grade of iron remaining the same, is ofttimes the difference between running at a commercial loss or a corresponding profit.

The burden is also effected by the richness of the ore mixture; for instance, notwithstanding the larger volume of slag, and, of course, the larger amount of flux usually used with 50 per cent ore, the furnace will carry a larger burden of a 50 per cent ore mixture than if it was 60 per cent. This is due to the chemical duty to be performed in the way of deoxidation. With a burden of 1.50 lbs. ore yielding 50 per cent the iron per pound of fuel is 0.75, while with a 60 per cent. ore it is 0.90 lbs. iron per one pound of fuel. A correspondingly larger amount of oxygen is to be removed by the gases in the latter case. Other things remaining the same, while the burden possible with a 60 per cent mixture is smaller than with a 50 per cent mixture, the fuel per ton of iron made will be less with the 60 per cent mixture. Magnetic ores are usually very dense, and more or less difficult to handle, parting with oxygen slowly. If ores are too finely divided physically they are a source of trouble. The gases, meeting more resistance in their ascent from the tuyeres, will seek the easiest way of escape. Channels of travel are apt to be formed, or, to speak technically, "the furnace becomes channeled." The effect is that portions of the furnace do not receive their share of the gas, and ore reaches the crucible holding oxygen in combination. This is destructive to the temperature of the crucible and represents a loss of fuel and waste of iron, to say nothing of the irregularities that will develop at and about the boshes, if the unequal distribution is not corrected.

Thus it will be seen that good judgment, skill and experience of the manager in selecting and combining ores to accomplish a certain end plays a very important part, and figures largely in the final result, measured in dollars and cents. Furnaces are not usually run for pleasure, nor for demonstrating any particular engineering device or the working out of any chemical theory, however attractive, but they are run for the sake of profit. Frequently, we are disappointed and sadly disappointed in results, but the man that combines technical knowledge with practical experience and an acquaintance with business conditions and requirements, with a due appreciation of their importance, is the man that will show the best final results and is the manager that is sought after. In the blast furnace business a little knowledge is very dangerous. The man, who in his own estimation knows it all, of course has no inducement to learn.

The flux usually employed is either limestone, calcite or magnesium, limestone, dolomite. Whether one or the other should be used depends upon circumstances, commercial and technical. Either will answer, so far as mere running is concerned. At the same cost per ton of stone, the use of calcite or dolomite will depend in great measure upon the composition of the ore mixture and the kind of iron to be made.

Pig Iron.

The various qualities of pig iron derive their names from the uses to which they are put or from their composition. Bessemer iron is pig iron of suitable composition to make Bessemer steel. Basic iron is pig iron suited for the basic open-hearth steel manufacture. Basic Bessemer is intended for the basic Bessemer converter. Foundry iron is for use in foundry to be remelted and cast into various forms. Mill iron is for use in puddling furnace to be converted into wrought iron. Low phosphorus iron is intended for use in acid open hearth steel manufacture and steel castings. Spiegel, ferro manganese and ferro-silicon are irons of particular composition, for special purposes, and require special ores and treatment in the blast furnace.

The Question of Blast.

Furnaces are now operated by volume of air blown per minute as distinguished from the old practice of running by pressure of blast. Pressure is now regarded in the light of one of the valuable indications of internal working or conditions. Calculated over long periods as measured by piston displacement and exclusive of wastage, between five and six tons of air are required to produce one ton of iron, and from 60 to 65 cubic feet of air to burn one pound of fuel, depending upon the tightness of pipes and fixtures and of the air piston of blowing engine. Atmospheric moisture plays an important part. It is never absent. It enters the tuyeres as vapor of water, calling for an increased amount of fuel to restore the heat absorbed by converting this vapor into its constituent parts, oxoygen and hydrogen. Whether the air contains five grains moisture per cubic foot or 10 grains, either must be provided for by extra fuel or higher heat of blast, if the temperature of crucible is to be maintained. On an average for any one year, probably 125 pounds of water per ton of iron will be forced into the tuyeres in the shape of vapor, while during the humid summer months, it may amount to 200 pounds and over. This is the reason why more fuel per ton of iron is required during the summer as compared with the winter months. As a rule less cubic feet of air is required per minute to consume same amount of fuel during the fall, winter and spring, months than during the warm months of the year.

Blast Furnace Management.

The modern blast furnace is not an invention, nor a discovery, but a growth. It represents the combined results of numerous experiences, and in itself is the epitome of many a hard-won fight. Sleepless energy and untiring devotion, perseverance in overcoming obstacles apparently unsurmountable, and the forgetting of self, has worked out many unsolved problems. Blast furnace management is fearful drudgery for a man not in love with his work. No department of iron or steel manufacture calls for closer application and attention to details. It is absolutely continuous. With these qualities lacking, no amount of technical knowledge will win success. The most successful managers have been those that were so absorbed in their work that they never stopped to inquire whether they were being suitably paid. The results obtained have shown that capital usually seeks out the best talent.

Time does not permit to more than merely mention a few of the improvements. The hearth with open forehearth and tympe gave place to the German patented, closed front. The principle, however, was worked out in American practice, we finally adopting a modified form of the Lurman device. Fire-brick stoves, an English invention, have practically replaced the cast iron pipe stoves for heating the blast. Enthusiastic agents, eager to swell their commissions, made extravagant claims for super-heated blast, in fact representing that brick stoves were really a panacea for all blast furnace ills. They have proved a valuable adjunct, but many failures and serious troubles, scaffolds, etc., followed their introduction in many instances. Numerous minor but important improvements have been made in tuyeres and tuyere fixtures, etc., permitting the replacing of tuyeres in five to 10 instead of 30 to 40 minutes. We have replaced tuyeres with only stoppages of two to three minutes. This may be considerably incredible by many furnace managers. We now use mechanical appliances for stopping the iron-tapping hole, an invention of Samuel W. Vaughan, manager of the Cambria Iron Co.'s furnaces, thus saving many long stoppages. When a furnace is making iron at the rate of eight to 10 tons per hour or more, the importance of every minute saved in stoppages can be appreciated.

One of the most frequent and troublesome of the mechanical difficulties is the formation of "scaffolds" in the furnace. A scaffold is an accumulation on the walls of the furnace, offering an obstruction to the regular and even descent of the material and diverting the uniform distribution of the gases. Scaffold material is an agglomeration of coal or coke, lime-

* A lecture delivered to third year students in metallurgy in the Schools of Mines and Chemistry, Columbia University.

stone and ore, partially fused into a solid mass and fastened to the walls. Sometimes scaffolds form a short distance above the tuyeres and gradually grow, extending far up into the shaft of the furnace. At others they commence at the top of the boshes, beyond the reach of the tuyeres, extending upwards and towards the center of the furnace. Not unfrequently the area of the furnace is so completely occupied by this solid mass that only a small opening, a few feet in diameter is left free from top to bottom. Of course the operations of the furnace are brought to an inglorious close, but usually only after a hard and laborious fight—a very expensive contest.

On other occasions the obstructions cause irregular working, inferior iron and high-fuel consumption, with excessive costs, but may not be sufficiently serious to put the furnace out of blast. As a rule, however, it does not pay to fight a serious melted scaffold in the hopes of restoring the furnace to good working condition. It may appeal to the professional pride of a manager to continue the fight, but as a commercial proposition it is usually cheaper to stop, shovel out and try again. Scaffolds are not as frequent as formerly, but they are still a serious menace and in one form or another are a constant source of danger and anxiety. It is estimated that fully 70 per cent of the heat of the crucible is brought into it by the solid materials which in their descent through the furnace come in contact with the highly-heated gas currents. The effect of any serious interruption to the regular descent of this stock can be thus appreciated. The working or acting area of the furnace being thus reduced by the scaffold accumulation, the flow of gases is confined to a restricted channel. The time of contact with the ores is lessened so that they reach the crucible unprepared for melting, which further lowers the temperature of the crucible. The blast meets with greater resistance, and at times the whole power of the engine fails to drive the air through the furnace. The flow of gas failing, the hot blast stoves are thus deprived of their source of heat, and the temperature of the blast falls. The boilers are fired with coal to maintain steam to operate pumps and keep the engine moving. Finally a passage may be opened and gas again flows through the stoves as the blast finally works its way through the obstruction. With the lowering of the temperature of the crucible the tuyeres are closed with a semi-fluid mass of iron and slag, communication between the tuyeres and cinder notch or slag opening and the iron tapping hole is obstructed by the partial chilling of the contents of the crucible. Days and sometimes weeks elapse before any iron of merchantable shape and quality is run into the pig beds.

My first experience of a genuine scaffold of the worst kind was a few months after I was entrusted with the responsibility of the management. During an absence of a few days my foreman filled into the furnace a lot of dirty limestone. The limestone shipments had been delayed by wet weather. The center of the stockpile was reached which proved to be very dirty from long continued dumping and the daily removal of clean stone from the edge of the pile. For two weeks I never saw a bed. The struggle lasted a month or more. Finally the furnace was restored to normal working condition, much to my gratification, but at great expense and loss to the company. I was thus early impressed with the importance of exercising the most careful watchfulness as to the preparation of the material filled into the furnace—ores, fuel and limestone. It was a valuable though a costly lesson, and I have since tried to make good use of it. It pays to use every precaution to prepare the stock before filling, rather than throw additional work on the furnace and run the risk of serious disturbance of its operations.

By experience we learn the various symptoms characteristic of disorders or variations from normal conditions, just as physicians determine disease. The correct diagnosis is more or less difficult and obscure, as different causes produce the same results. It is just as easy for the furnace manager to draw wrong conlcusions and administer the wrong remedy as for the doctor, though he may have the more or less intelligent assistance of his patient. In the meantime the patient in both cases suffers the penalty of ignorance, however excusable that ignorance may be on the part of the attending expert. Serious difficulties command the attention of even the average workmen. They mean hard work all around. In many instances less than one-half of the labor necessary to overcome troubles would would have prevented them altogether if the warnings had been observed—in other words, if the symptoms had been detected by close application and attention to details. I have always endeavored to impress this fact upon my foreman, by precept and example.

When the furnace is running along smoothly, then is the time for the manager to be watchful to give attention to minute matters and thus endeavor to keep her running regularly. The average man, under such conditions, is apt to become careless and neglectful. He fails to observe indications of importance, not purposely, but simply from lack of intelligent observation. Seeing, he sees not, that is, he does not perceive; the mind is dormant. Constant watchfulness and preparation for difficulties that may never come is no more an evidence of undue nervousness than a laudable ambition to improve one's condition is to be confounded with restless discontent, so disastrous to all effort.

The formation of scaffolds is due to many causes, and sometimes they apparently come from no traceable cause, simply from " pure cussedness." Scaffolds may result from the furnace being too hot, as well as too cold; from errors of fluxing or variations in materials (theory may be all right but practice all wrong); from improper filling of stock, either from badly proportioned bell, neglect in the stock house or on the part of the top filler; from long continued use of excessively basic slag, lime scaffolds may be formed, or from use of slags too silicious. Unexpected stoppages, due to accidents, allowing no time for preparation, may or may not be followed by scaffolds more or less serious. The gaugne of certain ores, fusing to a sticky mass at comparatively low temperature or the use of an easily clinkering coal, may be responsible. A hard and tough white ash coal is requred for blast furnaces. Volume of air blown, area of tuyeres and heat of blast, under certain conditions, are frequently important factors.

Time will not permit any reference to remedies employed to dislodge and remove scaffolds other than to remark that they are sometimes heroic, involving the liberal use of dynamite or practically blowing out or lowering stock below the scaffold, thus loosening it by melting away the foundation and then refilling. Methods will vary with circumstances and the judgment of manager. Other disturbances to uniform settling of the stock are known as " arching," " hanging," and " jumping " These invariably produce bad results. If continued, they add to the cost of the iron, and at the same time cause the production of lower grades and inferior quality. They are not necessarily dangerous. If not corrected, however, the conditions producing them may lead to a permanent melted scaffold. They may be considered as warnings of something worse to follow.

Accumulations may form on the bosh walls of considerable thickness that in no way interfere with the uniform working of the furnace. If these accumulations are evenly and regularly distributed they serve to protect the brickwork from fusing and from the destructive chemical action of the slag and gases. This coating at times forms an artificial bosh, more durable than the original brickwork, in fact a graphitic lining. Furnace " kish " corresponds closely in composition with native graphite, from which plumbago crucibles are manufactured. Artificial graphite contains more iron than the native, as the following analysis will show:

	Fe. %	SiO_2. %	C. %
Native graphite,	1.6 to 4.6	2.4 to 8 6	78 to 85
Artificial or furnace graphite,	17.3	2.20	70.74

When two or three tons of fuel were consumed per ton of iron, or when comparatively large furnaces made but small products, the artificial or furnace-made bosh lining served to lengthen the duration of the blast. Modern practice, however, does not rely upon this formation to protect the bosh walls, finding it inconsistent with fuel economy and large products.

The Acme Machinery Co., of Cleveland, manufacturers of bolt and nut machinery, including bolt headers, tappers and cutters, are full of orders and for some time past have been running 12 hours a day, though this is now reduced somewhat. The export trade has been very active recently and among the company's home shipments some important ones have been made to the West.

THE USE OF WIRE-WOUND GUNS.

In view of the immense trial successes which wire-wound guns have recently had in Great Britain, the apathy of artillerists in the United States in regard to this class of ordnance is hard to understand. Some three years ago the United States gave a conditional order for a Brown segmental wire-wound 10-inch gun, to be built at the Scott Iron Works, at Reading, Pa. The weight of this gun was to be 30 tons and the length 37½ feet; the steel wire was to have a tensile strength of 120,000 pounds per square inch, and to be wound around the core at a stress of 98,000 pounds per square inch. Since then, though this gun may have been finished and tested, there has been no sign of the adoption of it or any other form of wire-wound ordnance by the United States Army or Navy authorities. It is true that the national gun factories at Washington and Watervliet have lately been so successful in turning out large built-up rifle guns of the ordinary kind that American heavy guns have propably no superior in the world in strength and in accuracy of workmanship. But on the published figures, the British wire-wound guns, for equal calibres and weights, certainly seem to have the best of it.

The first, or almost the first, man who believed in the practicability of wire-wound ordnance was the great Brunel, who designed "Lucanias," huge bridges, big locomotives, and many other engineering wonders of modern times, before he had either tools or materials sufficiently good to manufacture them. Contemporary with him in projecting wire wound guns were Longridge, in England, who ultimately made the first serviceable gun of this kind, and Woodbridge and Very, in the United States. The first experiments were made independently on both sides of the Atlantic in 1855, but nearly 30 years were to elapse before steel wire of sufficient strength and homogeneity was forthcoming. Meanwhile, beginning in 1854, Armstrong had converted the whole world to his system of built-up guns, and Whitworth brought to perfection the art of casting gun steel ingots. It was not until 1886, when the Bethlehem Iron Co., in the United States, bought the trade secrets of Whitworth & Co., that the United States was able to take its rightful place in the manufacture of steel ordnance. Probably the success of the Armstrong method turned men's minds for a time from the problem of wire-wound guns. Yet the old stump and twist-barrel, known as Damascus twist, so highly valued by our fathers and grandfathers for rifles and fowling pieces, was nothing but a crude wire-wound process, the steel and iron rods being first welded into bars, rolled out into rods ⅛ of an inch square, and, finally, after some intermediate processes, coiled around a mandrel and welded. It would be almost impossible for a genius like Brunel to look at such an operation without seeing its adaptability to larger guns than the world had then seen.—[Cassier's Magazine for August.

The Production of British Armor Plate.

All the large armor plate making concerns in this country have of late been making arrangements for extending their output. There are at present four firms engaged in this industry, namely: Messrs. C. Cammell & Co.; J. Brown & Co.; Vickers, Son & Maxim, of Sheffield; with W. Beardmore & Co., of Glasgow. Another firm is about to be added to the list—Messrs. Armstrong, Whitworth & Co., who have almost completed at their Manchester works what will unquestionably be the most powerful armor-compressing plant in the world. The press which this notable firm have now in hand will be of 15,000 tons, with a cylinder of six feet diameter, and other dimensions to correspond. The company will shortly start on their first contracts for armor, which will be produced at Manchester, and not at Newcastle. The total annual productive capacity of the armor plants now available in this country will not be short of 50,000 tons a year, of a total annual value of about £5,000,000, at ordinary prices. Of course, this large quantity is not likely to be called for by the British Admiralty alone. It is probable that British manufacturers will continue to supply a large part of the armor required for the Chinese, Japanese, and South American navies, as well as our own, and these are likely to increase rather than diminish from year to year.—[Iron and Coal Trades Review.

The Oldest Steam Engine.

The oldest engine in the world is in the possession of the Birmingham Canal Navigation Co., and was constructed by Boulton & Watt, in the year 1777, the order being entered in the firm's books in that year as a single acting beam engine with chains at each end of a wood beam and having the steam cylinder 32 inches diameter with a stroke of eight feet, and erected at the Canal Co.'s pumping station at Rolfe st. Smethwick. During the present year this remarkable old engine, which has been regularly at work from the time of its erection to the current year a period of, say, 120 years, was removed to the Canal Co.'s station at Ocker hill, Tipton, there to be re-erected preserved as a relic ofwhat can be done by good management when dealing with machinery of undoubted quality. It is worthy of note that the Birmingham Canal Navigations favored Boulton & Watt in 1777, with the order for this engine, and in 1898, or 120 years afterwards, the company have entrusted the same firm, James Watt & Co., Soho, Smethwick, with the manufacture of two of their modern triple-expansion vertical engines, to be erected at the Walsall pumping station, having 240 h. p. and a pumping capacity of 12,713,600 gallons per day.—[Iron and Coal Trades Review, London.

"The Mineral Industry" for 1897.

The sixth annual volume issued under the title "The Mineral Industry, Its Statistics, Technology and Trade," by the Scientific Publishing Co., has come from the press recently. From 53 substances, whose statistics were collected for this publication in its first year, the number has now been increased to 100; and the magnitude of the work of collection and compilation might well daunt editors and publishers with facilities less complete, for commanding returns of this important industry. We have given the scope of the work in notices of previous volumes. The one before us is crowded with information of value to metallurgists, mining engineers, chemists, and all connected with the mineral industry on its technical and commercial sides. Much of the work is original; much is a compilation of the work of others. Not all is credited to the original sources; but the work in its entirety is exceedingly creditable and valuable. In its conception and breadth and scope and the ambitious scale of its execution, the work is representative of the spirit which has conspicuously marked American achievement in so many of the lines of which it treats. Richard P. Rothwell, editor of the *Engineering and Mining Journal*, is the editor, and he has been assisted by a large corps of statistical and technical contributors.

Axel Sahlin, formerly with the Maryland Steel Co., now representing the Brown Hoisting & Conveying Machine Co., of Cleveland, read a paper on conveying machinery before the Dusseldorf branch of the Verein Deutsche Eisenhuttenleute a short time ago. Mr. Sahlin said that at the opening of the present year there were in operation in the iron ore traffic of America 320 Brown unloading machines, having a daily capacity of 110,000 tons. Five coal handling plants had a capacity of 20,000 tons per day, of 10 hours. Only within the past year has the Brown machinery been seeking a market in Europe, yet already three bridge tramways have been placed at the Krupp works at Rheinhausen; two with the Krainische Industri Gesellschaft in Trieste; two are in operation at the new works of La Societe Providence, Mariopol, Russia; two other bridges have just arrived in South Russia, and within a few weeks orders for eight additional bridges have been received from other European points. The Brown company is also figuring upon the equipment for several plants upon which estimates have been requested by firms in England, Germany, France and Belgium.

The Forest City Foundry & Mfg. Co., of Cleveland, has taken a large number of orders recently from manufacturers of smaller agricultural implements and hardware specialties, in Michigan, Wisconsin and Illinois. The company's product is light gray iron castings, and at present it is melting about 30 tons of iron a day, employing 250 men. Prices are reported to be still very low on all light work, but in some instances slightly better than at this time last year.

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INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants :--

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

There are some negotiations between the Alcania Tin & Terne Plate Co., of Youngstown, O., and Sharon, Pa., land owners, for the erection of a four-mill black plate plant at Sharon.

The Burley Heater Co., capital $40,000, is about completing its new plant at Cold Spring Forge, near Tyrone, Pa. In addition to the manufacture of the heater, a general foundry and machine shop business will be carried on.

The Inter-State Malleable Iron Co. expects to equip the Iron Bay plant at West Duluth for the manufacture of car couplers, sufficient Eastern capital having been secured to insure the $7,000 pledged in Duluth.

The project for a malleable iron works at Grand Rapids, Mich., will soon be carried out, it is reported. It is in charge of Secretary Van Asmus, of the board of trade.

The Chicago Rail Joint Co., of Chicago, Ill., has been incorporated, with $25,000 capital stock. The incorporators are A. W. Charles, C. H. Binney and J. F. Curtis.

Proposals will be received at the office of the Supervising Architect, Washington, D. C., until 2 P. M., Aug. 9, for the removal of the old heating and ventilating apparatus and installation of a new heating and ventilating apparatus for the U. S. Custom House and Postoffice building, at Ogdensburg, N. Y.

New Construction:—

It is reported that the tin plate plant projected by Pittsburg capital, to be built at Monaca, Pa., will be erected by the Monessen Foundry & Machine Co., of Monessen, Pa.

The new works of the National Tin Plate Co., at Monessen, Pa., are expected to start up Aug. 1. Additional mills, not included in the original plan, are now being installed.

Plans have been made for the erection of a locomotive works by the Santa Fe Road, adjoining its car shops in Topeka, Kan.

In connection with the match factory now being erected at Phoenixville, Pa., a machine shop will be built for the construction of the match-making machinery.

A plant for the manufacture of horseless carriages is reported to be under construction at Kokomo, Ind., by Haynes & Apperson.

It is reported that works for the manufacture of farm machinery will be built at Appleton, Wis.

The Janney Mfg. Co. will erect buildings in Ottumwa Ia., to employ 200 men. Corn planting and corn husking machinery will be manufactured.

The Simplex Railway Appliance Co., Fisher Bldg., Chicago, is building quite an extensive plant for the manufacture of a car bolster made of steel channels and universal plate, at Whiting, Ind.

The Jamieson-Combe Iron Co., St. Joseph, Mo., has purchased ground, on which it will erect a machine shop 50 x 80 feet.

At Detroit, a permit has been granted for a one-story brick foundry, 120x65 feet for the Buick & Sherwood Co.

The Atchison, Topeka & Santa Fe Railroad Co. is building a boiler shop at Cleburne, Tex., to be 90x340 feet, of stone construction.

A press report says that the Titan Steel Co., a new Chicago corporation, has purchased from the Pullman Palace Car Co. a tract of land at Pullman, lying between 115th st., on the north, Calumet Lake on the south, and the Michigan Central Railroad on the west, for the site of a new steel plant. Options have been entered into by which the company will secure an additional tract, enabling it to double its plant if desired. The plant will give employment at the start, it is reported, to 500 men. The removal of some of the buildings

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SAN FRANCISCO, John Woodlock, 26 Beale St.

now on the property has been begun. The capital stock of the new company is $500,000. The incorporators are Eugene E Prussing, Frank H. McCulloch and Edward Bernman.

A small plant for the manufacture of brass and bronze articles and shapes is in course of erection on Preble ave., Allegheny. The main building will be 70x150 feet. About 50 men will be employed. Joshua Rhodes is reported to be a leading stockholder.

The Keystone Bridge Works have been awarded the contract for the structural steel work of the big bridge over the Allegheny river, at Moss Grove, Pa., at $150,000. The contract includes about 2,000 tons of steel. The new structure will be 125 feet high, 1,600 feet long, and 25 feet wide.

The Pittsburg Bridge Co. has received the contract for the immediate construction of a bridge 105 feet long over the South Tiger river, near Duncan's, S. C.

In addition to the two 500-ton blast furnaces, which are to be pushed forward as rapidly as possible, the Ohio Steel Co., Youngstown, O., has decided to build a continuous mill, similar to that of the Union Iron & Steel Co. It will have a capacity of 1,000 tons a day and will deliver 600 feet of small billets a minute. The equipment for the rail mill of the company will soon be purchased.

The Michigan Malleable Iron Co., of Detroit, will erect a mammoth plant in Delray, opposite the Solvay Process Co.'s works. The present plant of the company at 18th st. and the river will be abandoned. The company will be reorganized with an increase of capital from $100,000 to $200,000. W. C. McMillan will succeed Theo. D. Buhl as president and James and W. C. McMillan, with Thos. H. Simpson, treasurer and manager, will have the controlling interest. The new plant will be 375x585 feet and 5½ acres of land has been bought. Five foundries will feed the annealing room. At present 300 men are employed; the new works will give employment to 800. Malleable castings for agricultural concerns and railroad malleables will be manufactured.

Additions, Enlargements, Removals, Etc.:—

At McConnellsville, O., an addition is being built to the Brown-Manly Plow Co.'s works, and some new machinery added.

The Moline (Ill.) Implement Co., it is said, contemplates removing to Peoria, Ill.

The Minneapolis Rolling Mills at Columbia Heights, a suburb of Minneapolis, Minn., will soon add an open-hearth plant. The new buiding will be about half the size of the present one. Additional equipment will be purchased for the manufacture of railroad spikes, bolts and steel castings.

The Duplex Mfg. Co., South Superior, Wis., will build an addition to its foundry. Its facilities for manufacturing windmills and pumps will be increased considerably.

The Wellsville (O.) Plate & Sheet Iron Co. has purchased additional land and will extend its plant.

Williams, White & Co., Moline, Ill., will build an addition to the present foundry that will double its size and capacity. A new foundry building has been planned, to be 140 x 60 feet, making the entire length of building 240 feet.

The Kansas City Bolt & Nut Works, Kansas City, Mo., is erecting two new gas-producing furnaces, and a rolling mill occupying a space 250x120 feet. A big shear weighing 95,000 pounds will be added to the machinery.

The Clark Engine & Boiler Co., Kalamazoo, Mich., will erect an addition to its plant. A building 40 x 100 feet, two stories, will be built at once to be used as a machine shop and blacksmith shop.

At Springfield, O., the Warder, Bushnell & Glessner Co. will begin immediately extensive improvements. Seven warehouses will be constructed, the largest being 60x600 feet and five stories, to give storage room for the binders and mower. The business of the company is unprecedented.

Additions to be made to the plant of the McCormick Harvesting Co., at Leavitt st. and Blue Island ave., Chicago, will cost $18,000.

Stanley G. Flagg & Co. have awarded the contract for an additional building to their iron foundry, at Pottstown, Pa. The new structure will be of brick, 70x40 feet, and will be used for storage purposes.

The Riter-Conley Co. has the contract for the addition to the plant of the Schoen Pressed Steel Co., Allegheny. The new building is to be 705 feet long with a span of 120 feet. It is to be a steel buildin. the roof and sides to be of corrugated sheet steel.

The Storey Motor & Tool Co. has moved its main office and factory from Philadelphia to 464 South Broad st., Trenton, N. J., in the plant with the Trenton Iron Co. This change was made necessary by the greatly increased demands for the electrical machinery of its manufacture, particularly its multipolar, entirely enclosed, dust and moisture-proof motors. It was the first of this style to be placed on the market, several years ago. The motors at present manufactured by the company have been improved both mechanically and

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electrically, advantage having been taken of years of experience. The machines have some special features together with light weight, high efficiency, slow speeds and special form which makes them particularly adapted to all classes of direct connected, machine tool, hoist, crane, mill and mine service—in short, any variety of combination. With its increased facilities the company will also push on the market its open type machines for all classes of standard work, together with several lines of specialties which up to the present time it has been unable to put upon the market. Within a short time the company expects to have everything running in proper order and will be pleased to give any details and descriptions of its machines, upon inquiry.

The Frontier Iron Works, Detroit, Mich., are adding new brass furnaces and increasing the size of their brass foundry, to take care of the increase in their valve business.

The National Malleable Castings Co. will expend $50,000 in the construction of an addition to its plant at 26th st., and Blue Island ave., Chicago. Two buildings will be erected, one 60x350 feet, and the other 60x150 feet. Both will be two stories.

Runyan & Monch, proprietors of the New Castle Bridge Works, New Castle, Ind., will greatly enlarge and improve the plant by the erection of several new buildings and new machinery.

The Phoenix Foundry & Mfg. Co., Lansdale, Pa., is building an addition to its foundry to be 75x150 feet.

The converter and billet mills at the Illinois Steel Co.'s plant, Joliet, Ill., resumed July 20, after a 10-days' shut-down.

Fires and Accidents:—

At Corning, Cal., W. Liersch's agricultural works and J. G. Connor's plant adjoining were destroyed by fire. The loss is total.

The Besley Machine Works, at Beloit, Wis., were damaged $2,000 by fire July 20.

The Brainerd Milling Machine Co., of Hyde Park, Mass., suffered a loss of $30,000 to its building and machinery by fire July 24, the rear of the main building being practically destroyed. The 100 employes thus thrown out will soon be employed in other buildings of the company.

At New Castle, Pa., fire in the pickling department of the New Castle Tube Co.'s plant caused a loss of $4,000.

At Chattanooga, Tenn., the Milburn-Bass wagon works burned, with loss of $125,000; partly insured.

The factory of the Ellicott Cycle Mfg. Co., North Tonawanda, N. Y., burned July 22; loss $50,000. The total loss will be in the neighborhood of $75,000

General Industrial Notes:—

The Ahrens & Ott Mfg. Co., of Louisville, Ky., has bought the Birmingham (Ala.) Pipe Works, and will continue the manufacture of soil pipe there.

The Toledo Machine Tool Co., Toledo, O., recently received a London order for several power stamping presses. The past year's business has been the largest in the company's history and the June total was the largest for any month.

A large volume of summer orders caused the resumption of the Arcade File Works, at Anderson, Ind., last week.

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The specialty department of the American Steel & Wire Co.'s plants in Cleveland, devoted to fine wire, will be equipped with modern appliances and its tonnage considerably increased.

The Phelps Plow Works, at Phelps, N. Y., burned down some months ago, have been rebuilt and operations will soon be resumed.

Headers in the Anderson, Ind., bolt works refused to accept the reduction and the plant is shut down.

Employes of the American Steel & Wire Co., at Anderson, Ind., refuse to accept the re-arrangement of work and the reductions in wages, ranging from 10 to 35 per cent. The change gives 13 men to a turn, instead of 18, and these 13 men are required to operate 15 machines, instead of 9.

The American Steel & Wire Co.'s plant at Rankin, Pa., will resume Aug. 15. The changes to be made will materially increase the output.

The plate mill which is to be removed from Brilliant, O., to the Belmont mill, Wheeling, W. Va., will be erected on ground recently cleared of 70 cut nail machines.

The Decatur (Ill.) Malleable Iron Works will start up in August, it is announced, under a reorganization. Some improvements are to be made.

The Bradley agricultural works at Kankakee, Ill., owing to the difficulty of securing malleables, canceled a large number of orders. The company will soon have a plant of its own, having purchased the Laing machine works, which will be appropriately equipped for malleable works.

The $683,000 carried to surplus by the Bethlehem Iron Co. in the last fiscal year makes surplus account $5,369,100. Current assets over liabilities, $3,139,722. The unfinished orders on the company's books at the end of the year were $6,500,000, exclusive of $1,000,000 for armor and forgings for Russian warships.

The Alabama Rolling Mill Co., and the Birmingham Rolling Mill Co., in the Birmingham district, have resumed in part and will be in full operation by Aug. 1. Last year's shutdown was from six to eight weeks.

The election of officers of the Chase Machine Co., of Cleveland, was held July 15. James L. Chase was made president and general manager; Walter Williamson, vice-president, and Frederick Metcalf, secretary and treasurer. Mr. Chase was 15 years a lake engineer and has been master mechanic as well as general manager of the company since its formation. Mr. Williamson was connected with the McDermott & Williamson Twist Drill Co., and has much experience as foreman and superintendent. Mr. Metcalf is a Massachusetts Institute of Technology graduate in mechanical engineering and for a number of years has had experience in marine and hydraulic work. The company will manufacture the Chase steering gear, hoisting engines, and power and drop hammers, and do general job work in machinery and steam engineering lines.

Very extensive improvements have been under way for some time at the South works of the Lackawanna Iron & Steel Co. Operations will be resumed, it is expected, by Aug. 15. At the furnaces, where formerly ore was unloaded from cars to buggies and then hoisted, the loaded cars are now run down an incline to the elevator, and another incline returns the empties. Crane hoists and three Crane engines are provided for elevating the stock. In the Bessemer steel department new and larger cupolas have been provided. Ingots will be poured on cars, and a hydraulic crane has been installed to handle the ladles. The old heating furnaces have been torn out. Two Morgan cranes are employed for handling ingots in the pit furnace building. An ingot of 18 inches square section will be used in the new rail mill. A new Porter-Allen engine has been installed. There will be no reversing. After the last finishing pass, the piece will be sawed into four rails. New tables and other new equipment in the rail mill have been provided. The changes are calculated to effect marked economies in rail manufacture, and to make the plant more thoroughly modern.

The Tennessee Coal, Iron & Railroad Co. had $53,629 net earnings and $47,479 charges in June against $38,850 earnings and $47,777 charges in June, 1897—making a June surplus of $6,150 this year, compared with a deficit of $9,227 last year.

Laughlin & Co., Ltd., operating the three Eliza furnaces at Pittsburg, will rebuild these stacks. They will be made 100 feet high and the boshes enlarged to 21 feet. Other improvements will be made to bring the output up to 500 tons a day each. The plan will be adopted of blowing out only one stack at a time. The three remodeled furnaces, with Soho, will yield 1,800 tons a day.

Dover Furnace, of the Penn Iron & Coal Co., Canal Dover, O., started up on July 12, after repairs. A new hearth, bosh and lining were added, and two new boilers of 250 h. p. each were installed. The output is now larger than before.

The Maryland Steel Co. has secured a Government contract to build 10 gun carriages for 12-inch guns, the first to be delivered by October and one each month thereafter.

Claire Furnace, of the Claire Furnace Co., Ltd., at Sharpsville, Pa., has blown out for repairs.

The new foundry of the Standard Iron Works, Los Angeles, Cal., is completed. A 10-ton crane has been installed.

The employes of the Semet-Solvay by-product coke ovens of the Dunbar Furnace Co., at Dunbar, Pa., have been given an advance of 10 per cent in wages, and will receive a further advance of 10 per cent when the blast furnace is put in operation.

The Weimer Machine Works Co., of Lebanon, Pa., has received an order from the Lorain Steel Co., of Lorain, O., for 10 patent cinder cars of 200 cubic feet capacity each. The Lackawanna Iron & Steel Co., of Scranton, Pa., has also placed an order with the Weimer company for a Weimer air cylinder complete, of 84 inches diameter by 84 inches stroke, to be placed on a new blowing engine the Lackawanna company is now builing at its shops in Scranton.

The King & Andrews Co. announces, in connection with its occupancy of its new foundry at Chicago Heights, Ill., that

the C. & E. I. R. R., M. C. Ry., and E., J. & E. Ry. have tracks into its yards, giving it the best shipping facilities to all points. A car is sent from the foundry to Chicago every day.

A large order for electrical apparatus was received last week by the Walker Company, of Cleveland. The order came from the Paris agency of the Walker Co., and was for 500 complete street railway motor car equipments, comprising 1,000 25-h. p. motors, 1,000 controllers, and 500 trolleys.

The Dee-e & Mansur Implement Co., Moline, Ill., is putting in a cupola for continuous melting.

The Shelby Steel Tube Co., Greenville, Pa., plant is undergoing extensive repairs. Thirteen new draw benches are being put in, which will be operated hydraulically.

The Sharon Boiler Works, of Sharon, Pa., has the contract for building two blast furnace shells for the Lorain Steel Co., at Lorain, O.

Four new hot blast stoves are being built at the Reading Iron Co.'s Keystone Furnace, in Reading, Pa., and new boilers are to be put in. Repairs will also be made to the engines and the furnace will be blown in in the fall.

Contracts have been made by the Ohio Steel Co., Youngstown, O., with the Snow Steam Pump Co., of Buffalo, for three compound triple expansion pumping engines, capable of pumping 6,000,000 gallons a day.

The Ohio Steel Co., of Youngstown, at its annual meeting July 19, elected the following directors: J. G. Butler, Jr., James Parmalee, Henry Wick, Myron C. Wick, George D. Wick, E. L. Ford, E L. Brown, and Tod Ford. Henry Wick was elected president, J. G. Butler, vice-president, and W. H. Baldwin secretary and treasurer.

The foundry of the Pottsville, Pa., shops of the Philadelphia & Reading Coal & Iron Co. has closed down indefinitely.

The Ludlow Valve Co., of Troy, N. Y., recently made the heaviest valve ever cast and made complete in any one shop in the world. The valve, which was shipped to Mexico, weighs 34,500 pounds and is about 18 feet high and 8 feet wide, the diameter being 72 inches. An order has just been received for 925 valves, ranging in size from four to 28 inches, from St. Petersburg, Russia, to be used in the construction of the Moscow water works. The Ludlow company had as competitors for the contract English, German and Russian manufacturers.

The S. Obermayer Co., Chicago, has sold a complete foundry equipment, including one cupola, ladles, etc., and a complete outfit of supplies for the mechanical department of the University of Nebraska, at Lincoln, Neb.

In June, Shenango Furnace of the Shenango Valley Steel Co., at New Castle, Pa., made 8,520 gross tons of Bessemer pig iron, an average of 284 tons per day. The furnace was only started on May 22, and is only 80x17½ feet.

The East Lebanon Iron Co., Lebanon, Pa., last week put its 28-inch mill on double turn. It had been running on single turn for some time.

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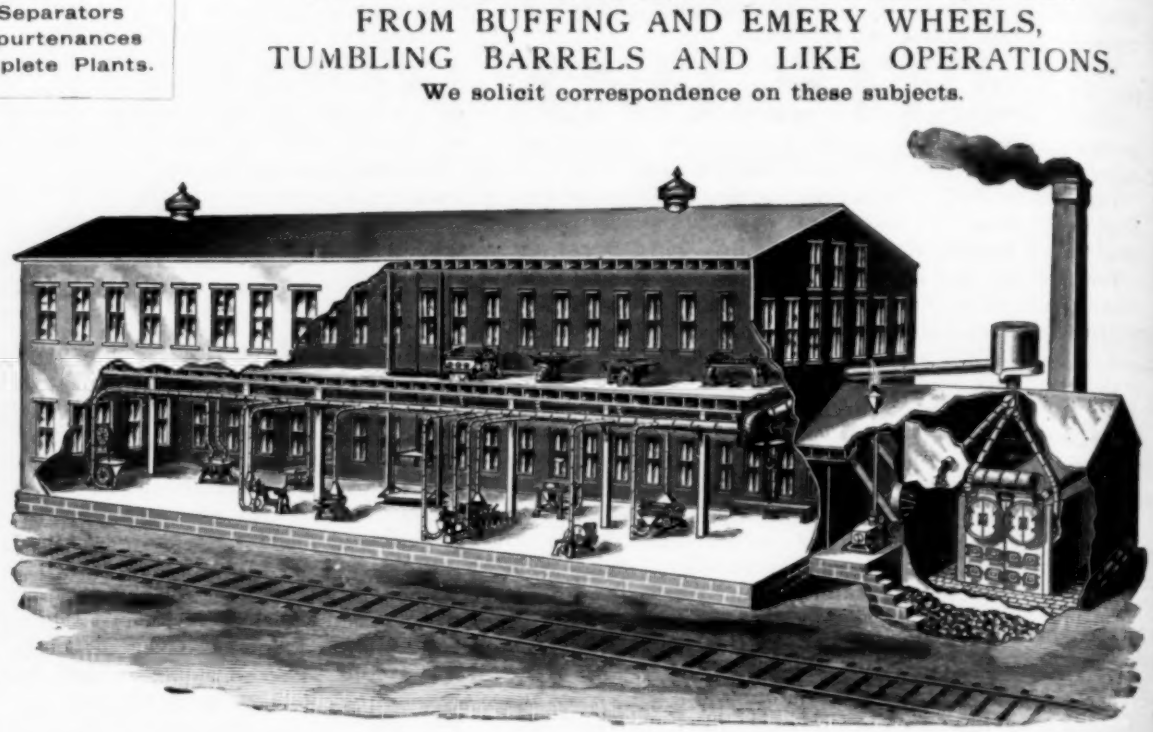

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